A STUDY OF LIPID PROFILE IN CHRONIC KIDNEY DISEASE PATIENTS

Dissertation submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

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In partial fulfilment of the regulations

for the award of the degree of

M.D. DEGREE BRANCH - I

GENERAL MEDICINE

GOVERNMENT MOHAN KUMARAMANGALAM

MEDICAL COLLEGE, SALEM

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CERTIFICATE

This is to certify that this dissertation **"A STUDY OF LIPID PROFILE IN CHRONIC KIDNEY DISEASE PATIENTS"** is a work done by **Dr. M. RAJESH** under my guidance during the period of 2010 - 2013. This has been submitted to the partial fulfilment of the award of M.D. Degree in General Medicine (Branch I) Tamil Nadu Dr. M.G.R Medical University, Chennai-32.

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DECLARATION

I solemnly declare that this dissertation **"A STUDY OF LIPID PROFILE IN CHRONIC KIDNEY DISEASE PATIENTS"** was prepared by me at Government Mohan Kumaramangalam Medical College and Hospital, Salem-636030 under the guidance and supervision of **Prof. Dr. A. THANGARAJU,** M.D., Associate Professor of General Medicine, Govt. Mohan Kumaramangalam Medical College and Hospital Salem. This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in fulfilment of the University regulations for the award of the degree of M.D. General Medicine (Branch I)

Place : Salem

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A DISSERTATION

ON

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BRANCH I

CONTENTS

INTRODUCTION

Chronic kidney disease refers to the permanent loss of renal function leading to impairment of excretory and endocrine functions of kidney. Signs and symptoms of chronic renal failure is termed as uremia.

In chronic kidney disease patients major lipid abnormalities are decreased HDL cholesterol and increased triglyceride, which cause atherosclerosis resulting in Coronary artery disease.

Chronic kidney disease causes hypertension, which is also a predisposing factor for atherosclerosis and coronary disease.

In Chronic kidney disease patients cardiovascular diseases are the major cause of mortality and morbidity.

Dyslipidemia accelerates the progression of Chronic kidney disease.

Indian studies on lipid abnormalities in chronic kidney disease ,such as, Sharma et al and Kundu et al found no hyperlipidemia whereas, Gupta et al and Das et al observed hypertriglyceridemia and reduced HDL cholesterol in Chronic kidney disease patients. In view of this

inconsistency and limited evaluation in southern part of India extended research on the topic is needed.

Our study is presented to highlight the importance of dyslipidemic complications of CKD and early diagnosis can prevent the cardiovascular complications.

AIMS AND OBJECTIVES

- To estimate various lipid profile abnormalities in Chronic Kidney Disease patients.
- To identify the predominant lipid pattern abnormality in chronic Kidney Disease patients.

REVIEW OF LITERATURE

HISTORICAL REVIEW

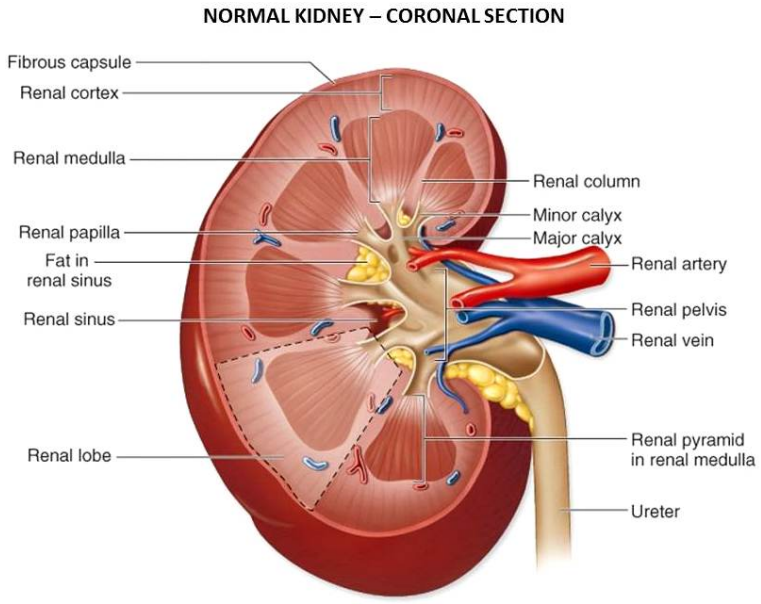
- Charaka explained the different varieties of prameha or urinary affections in 2nd century.
- Hippocrates has given detailed description of renal diseases. He diagnosed certain affections of the kidney by urine examination.
- Jacob Henle (1840) showed urinary casts under the microscope and correlated them as the Nephritic Kidney at autopsy in 1847.[1]
- In 1847, Piorry P.A. Coined the term UREMIA, the primary abnormality in renal insufficiency, namely the retention of urine in the blood. This theory persisted into the 20th century, and the role of urea and other retained toxins was particularly emphasized.[2]
- Frederick Wohler in 1882 synthesized urea in the laboratory.
- Frederick and Akbar Mohammad (1849-84) noticed the relationship between hypertension and renal disease.[3]
- Herman Strauss in 1912 described urea estimation in the evaluation of kidney disease. Otto Folin in 1912 improved on the method by introducing the colorimetric method.

- Franz Volhard in 1918 introduced the specific gravity concentration test into clinical work.[3]

- Simillie noted the deleterious effects of potassium administration to uremic patients in 1915 and Boeher incriminated magnesium toxicity in many of the central nervous system manifestations of uremia.

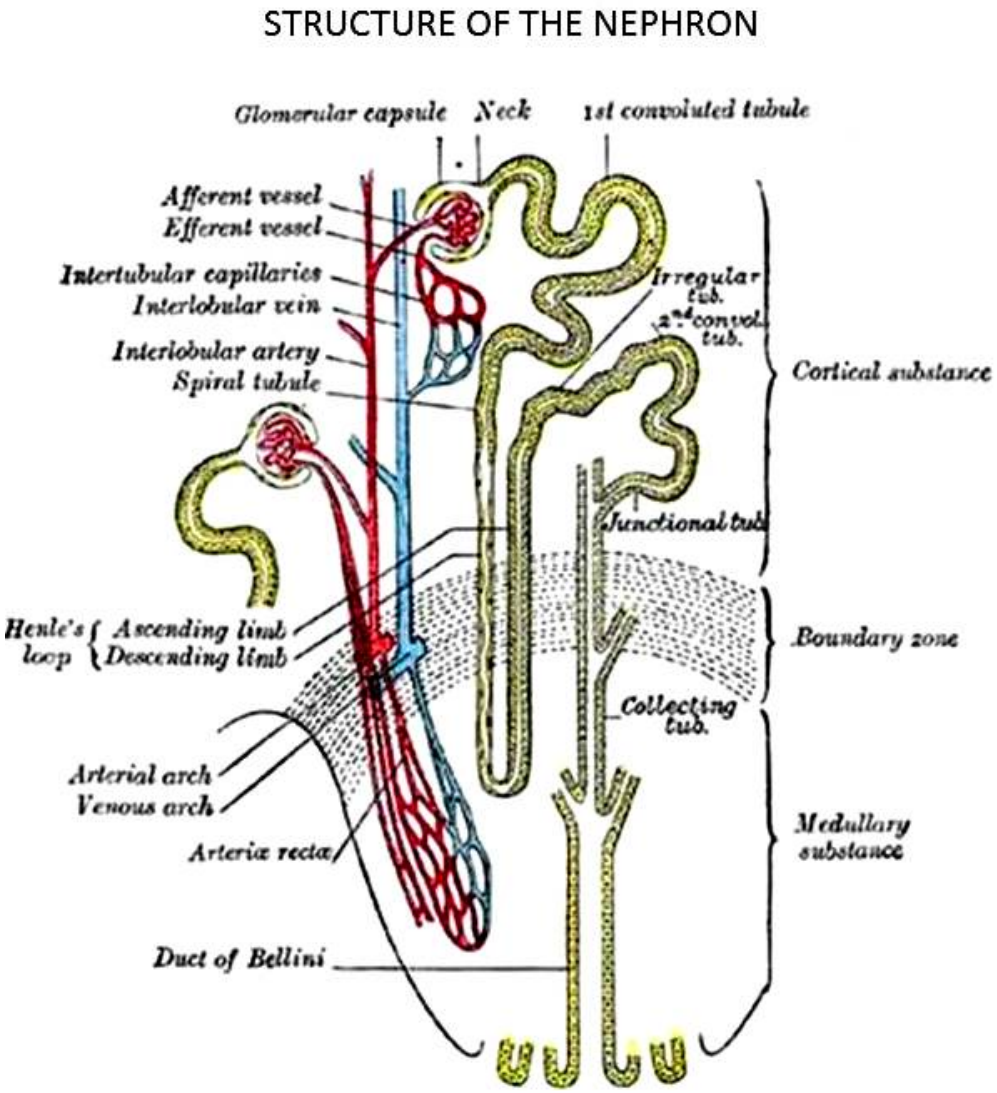
- In 1928 Openheimer and Fishberg first clearly distinguished hypertensive encephalopathy from uremia.

NORMAL KIDNEY - Anatomy[4]



The kidneys are paired retroperitoneal organs situated in the posterior part of the abdomen on each side of the vertebral column.

The upper pole of each kidney lies opposite to the 12th thoracic vertebra and the lower pole of each kidney lies opposite to the third lumbar vertebra.



The weight of each kidney ranges from 125 to 170 gm. in adult man and 115 to 155 gm. in adult woman. In humans, the kidney is usually 11 to 12 cm. in length 5.0 to 7.5 cm. in width and 2.5 to 3.0 cm in thickness.

Functions of the kidney

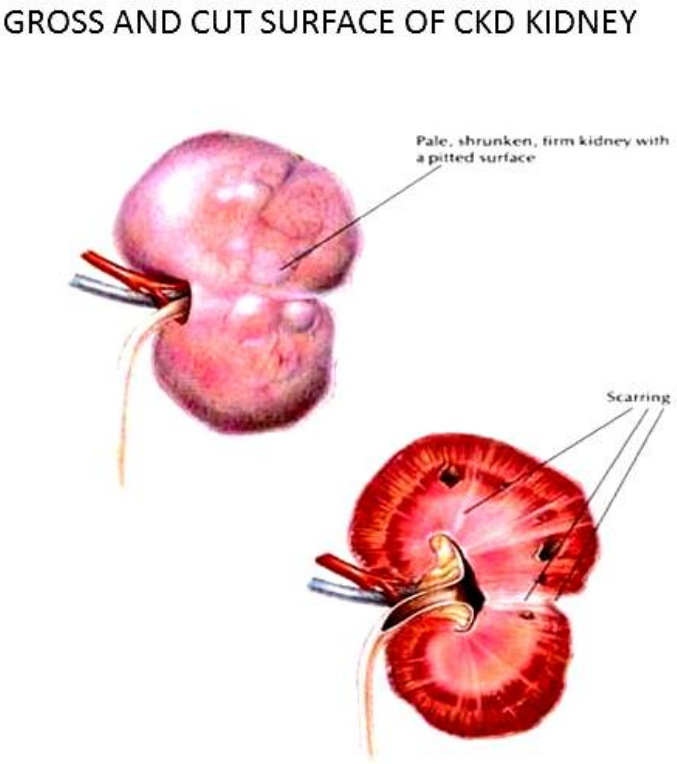
The main function of the kidneys is the excretion of waste products derived from metabolism, toxic substances and some drugs.

Kidneys also performs several other important functions which are essential in maintaining normal homeostasis. These are

- Maintenance of fluid and electrolyte balance
- Maintenance of acid-base balance.
- Maintenance of normal blood pressure through renin-angiotensin system
- Endocrine functions.
    1. Conversion of 25(0H)2 D3 to 1,25(OH)2 D3 occurs in kidney .
    2. Erythrpoietin production also takes place in kidney.
    3. Synthesis of prostaglandins which play an important role in renal auto regulation of blood flow.
- Ammonia formation which plays important role in maintaining acid base balance.

CHRONIC RENAL FAILURE

Chronic kidney disease[5]



Definition

1. Kidney damage for more than 3 months as defined by structural or functional abnormalities of the kidney, with or without decreased GFR, manifested by either,

- Pathological abnormalities or,
- Markers of kidney damage including abnormalities in the composition of the blood or urine or abnormalities in imaging tests.

2. GFR < 60ml/min/1.73m2 for ≥ 3 months, with or without kidney damage.

The presence of chronic kidney disease should be established based on presence of kidney damage and level of kidney function (glomerular filtration rate), irrespective of diagnosis.

Among patients with CKD the stage of disease should be assigned based on the level of kidney function, irrespective of diagnosis according to the KDOQI CKD classification.

HISTOLOGICAL PROGRESSION OF CKD

GFR

GFR is calculated using Cockcroft and Gaultformula[6]

Estimated creatinine clearance in ml/min:

(140-age) X Lean body weight /72X plasma creatinine (mg/dl) Multiplied by 0.85 for women.

Chronic renal failure is a syndrome, which results from progressive and irreversible destruction of nephrons regardless of the etiology, where the kidney is no longer able to maintain the biochemical homeostasis. The syndrome is complex and the biochemical changes and clinical signs are variable and mostly non-specific.

Chronic renal failure may result from any destructive and progressive condition affecting both the kidneys. It implies failure of both the glomerular and tubular functions. By convention ,acquired tubular defects or isolated congenital defects are not included in the consideration of chronic renal failure.

Chronic renal failure may be asymptomatic or symptomatic. Kidney has a tremendous reserve capacity. About 80% of renal function will be lost before the renal failure develops.

Thus, the GFR usually would have fallen to about 40 ml per minute, before the blood urea nitrogen or creatinine levels raise above the upper limits of normal. Azotemia refers to the accumulation of nitrogenous waste products in the blood and is reflected as elevated blood urea nitrogen.

'Uremia' is defined as symptomatic renal failure

Stages of chronic kidney disease[5]

Stage	Description.	GFR ml/min /1.73m^2
1	Kidney damage with normal or ↑GFR	> 90
2	Kidney damage with mild ↓GFR	60-89
3	Moderate ↓GFR	30-59
4	Severe ↓GFR	15-29
5	Established Renal Failure	<15(or dialysis)

Aetiology of chronic renal failure[7]

The etiological spectrum of CRF differs somewhat in different parts of the world[7]

Primary glomerulonephritis is the commonest cause of CRF in developing countries of the world, whereas diabetic glomerulosclerosis is emerging as the most common cause of CRF in developed countries where life expectancy of diabetics has increased considerably as a result of better diabetic care[7]

Diabetic and hypertensive nephropathy are the leading underlying etiologies of both CRD and ESRD[8].

Important causes of chronic renal failure.

- Primary glomerulonephritis
- Secondary glomerulopathy –systemic disease
- Interstitial renal disease.
- Hypertensive renal disease
- Obstructive nephropathy
- Heredo-familial renal disease

Pathophysiology of chronic renal failure

Progressive Nephron loss and adaptations[7]

In CRF the number of nephrons goes on diminishing with passage of time. As nephrons continue to be lost, the remaining undamaged or less severely damaged nephrons undergo certain changes. Experimental studies have shown that the single nephron GFR in remaining intact nephrons, tends to increase and they undergo compensatory hypertrophy. At this stage of disease, GFR can be maintained normal, despite reduced number of nephrons until the limits of increase of single nephron GFR is reached.

These beneficial compensatory adaptations in residual renal function ultimately have harmful systemic and renal effects. These have been termed as trade off hypothesis[9].

There is some evidence that supports the trade –off hypothesis. The adaptive increase in phosphate excretion per nephron that typically occurs in CRD is thought to be mediated at least in part by parathormone, and the levels of this hormone have been found to rise progressively throughout the course of CRD. The Consequence of this secondary hyperparathyroidism however extends far beyond the promotion of increased fractional phosphate excretion rates.

Middle molecule hypothesis[10].

The discrepancy between the severity of symptoms and the degree of azotemia seems to be most marked in patients who are treated with maintenance peritoneal dialysis.

Despite high BUN and serum creatinine levels, the symptoms of uremia are mild and peritoneal dialysis patients may be less prone to developing peripheral neuropathy than are hemodialysis patients.

These observations suggest that toxicity is related to the accumulation of higher molecular weight substances, which are cleared more readily by peritoneal dialysis, than by hemodialysis.

The peritoneal membrane is more permeable to solutes of middle molecular weight[11] (Aproximately 500 to 3000 daltons) compared to hemodialysis membranes. The middle molecule (MM) hypothesis predicts that shortening the duration of dialysis will jeopardize the removal of these compounds, despite the same clearance of smaller solutes.

The MM hypothesis has a number of shortcomings. First, the efficiency with which dialysis corrects the uremic syndrome argues in favour of low molecular weight solutes, playing the pathophysiologically pre- eminent role.

Second, most solutes are of low molecular weight and are not of MM size[12].

In summary the MM hypothesis remains controversial, despite a great deal of research.

Clinical Features

Fluid and electrolyte disturbances

- Volume expansion
- Hyponatremia, Hyperkalemia
- Hyperphosphatemia

Endocrine - Metabolic disturbances[13,14,15]

- Secondary hyperparathyroidism, Adynamic bone disease
- Vit. D deficient osteomalacia[16]
- Hyperuricemia, Hypertriglyceridemia
- Increased Lp (a) levels, Decreased high density lipoprotein level
- Malnutrition
- Amenorrhea ,infertility and sexual dysfunction
- α2 macroglobulin associated amyloidosis

Neuromuscular Disturbances

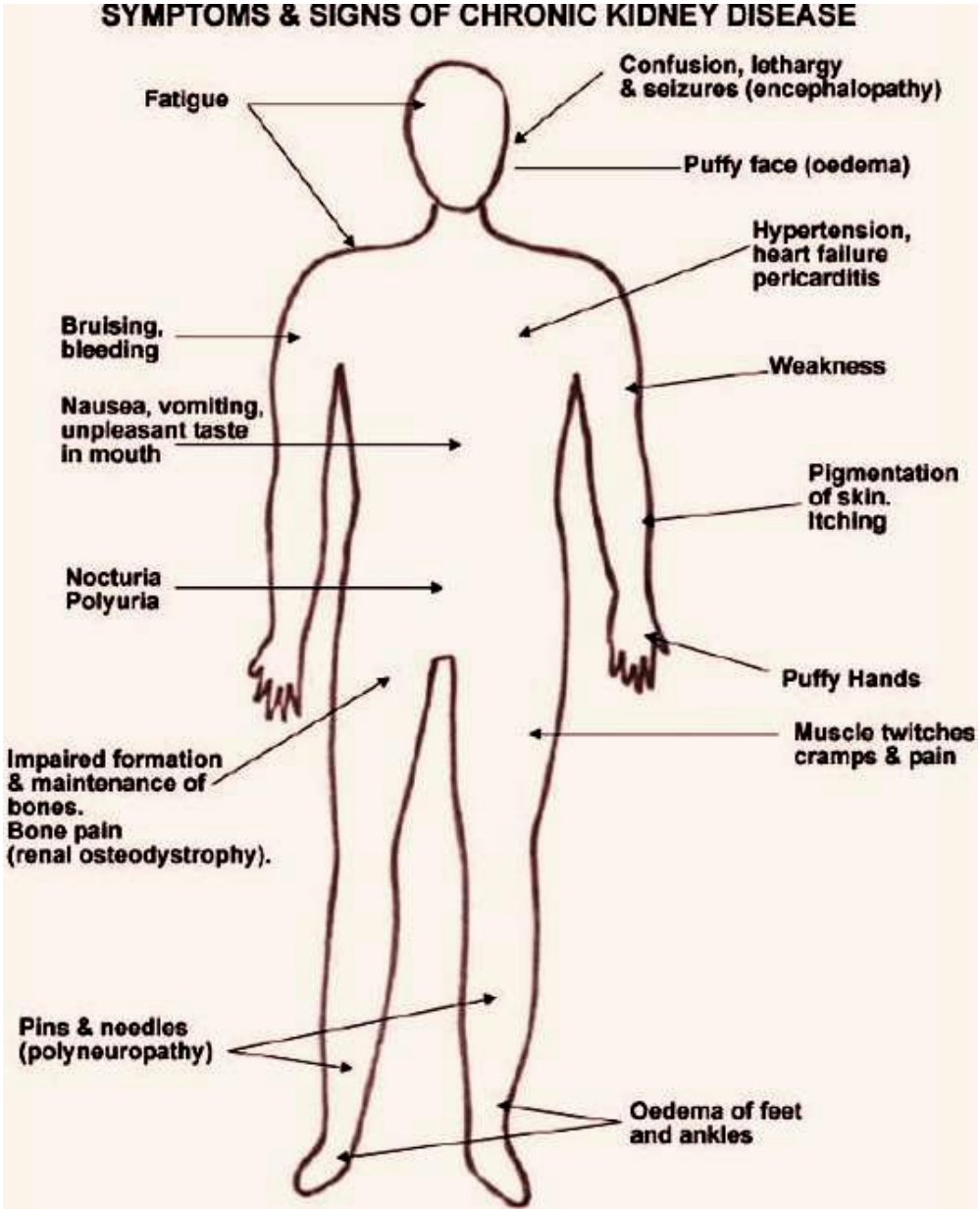
- Fatigue, Muscular rigidity
- Peripheral neuropathy, Restless leg syndrome
- Myoclonus[17]
- Seizures, Coma[18,19], Muscle cramps
- Dialysis disequilibrium syndrome
- Sleep disorders, Headache, Impaired mentation
- Lethargy, Myopathy, Asterixis[20]

Cardiovascular and pulmonary complication

- Arterial hypertension[21,22,23], Pericarditis[24]
- Hypertrophic or dilated cardiomyopathy, Uremic lung[25,26]
- Congestive heart failure or pulmonary edema
- Accelerated atherosclerosis, Hypotension and arrhythmias
- Vascular calcification[27]

Dermatologic Disturbances[28,29]

- Pallor, Hyperpigmentation
- Pruritus, Ecchymoses
- Fibrosing dermopathy, Uremic frost



Gastro Intestinal disturbances[30,31]

- Anorexia, Nausea and vomiting
- Gastrointestinal bleeding, Idiopathic ascites
- Gastroenteritis, Peptic ulcer, Peritonitis

Hematologic and Immunologic disturbances[32]

- Anemia, Leukopenia, Thrombocytopenia
- Lymphocytopenia, Increased susceptibility to infection
- Bleeding diathesis

Management of Chronic Renal Failure

The optimal timing of therapy is usually well before a measurable decline in GFR and certainly, before CKD is established.

1. Diet

    - Protein restriction 0.6-0.75g/kg/day

    - Low salt 60-80mmol/day

2. Blood pressure control

    - Bp<130-135/80-85mmHg if proteinuria <1g/24 hr

- Bp<125/75 mmHg if proteinuria >1g/24 hr

3. Proteinuria

- to reduce to <1g/24hr, use an ACE inhibitor or angiotensin receptor antagonist

4. Glycemic control in DM

- Hb AIC < 7%

5. Dyslipidemia

-Control individual lipid fractions

6. Smoking

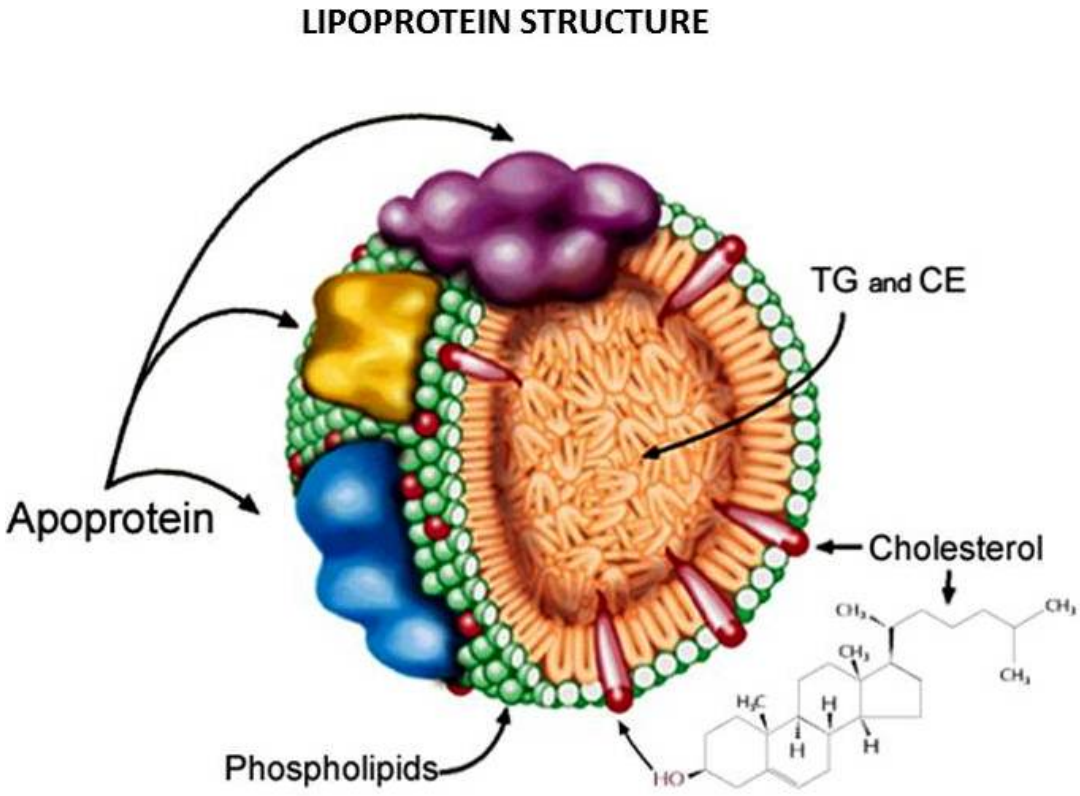
- cessation

7. Alcohol

- Restriction to less than 2 drinks per day.

LIPOPROTEIN METABLISM

Lipoproteins are complexes of lipids and proteins that play a main role in the transport of cholesterol, triglycerides and fat soluble vitamins. Because the lipids are hydrophobic they need a transporter in the form of proteins to transport them through body fluids across tissues. These lipoproteins are necessary for transport of triglycerides, cholesterol and fat soluble vitamins from the liver to peripheral tissues; and transport of cholesterol from peripheral tissues to the liver.



The structure of lipoprotein is basically a neutral lipid core surrounded by a coat shell. Lipid core constituents are triacylglycerol and

cholesteryl ester, whereas the shell is formed by phospholipids and cholesterol. Phospholipids and cholesterol are amphiphilic that's why, they are exposed on the surface of the lipoproteins and triacylglycerol and cholesteryl ester are hydrophilic, so they are placed in the core.

Classification of lipoproteins

Five major classes of lipoproteins are identified in human plasma, based on their separation according to density by electrophoresis.

1. CHYLOMICRONS: They are synthesised in the intestine and transported exogenously i.e dietary triacylglycerol to various tissues. They constitute highest quantity of lipid, which have low density and larger size than that of proteins, and lowest quantity of proteins. So the chylomicrons are least in density and largest in size, among the lipoproteins

2. VERY LOW DENSITY LIPOPROTEINS: They are produced in the liver and intestine and are responsible for the transport of endogenously synthesized tiacylglycerols.

3. LOW DENSITY LIPOPROTEINS: They are from VLDL in the blood circulation. They transport cholesterol from liver to other tissues

4. HIGH DENSITY LIPOPROTEINS: They are mostly synthesized in the liver. Three different fractions of HDL can be identified by ultracentrifugation, HDL1, HDL2 and HDL3.

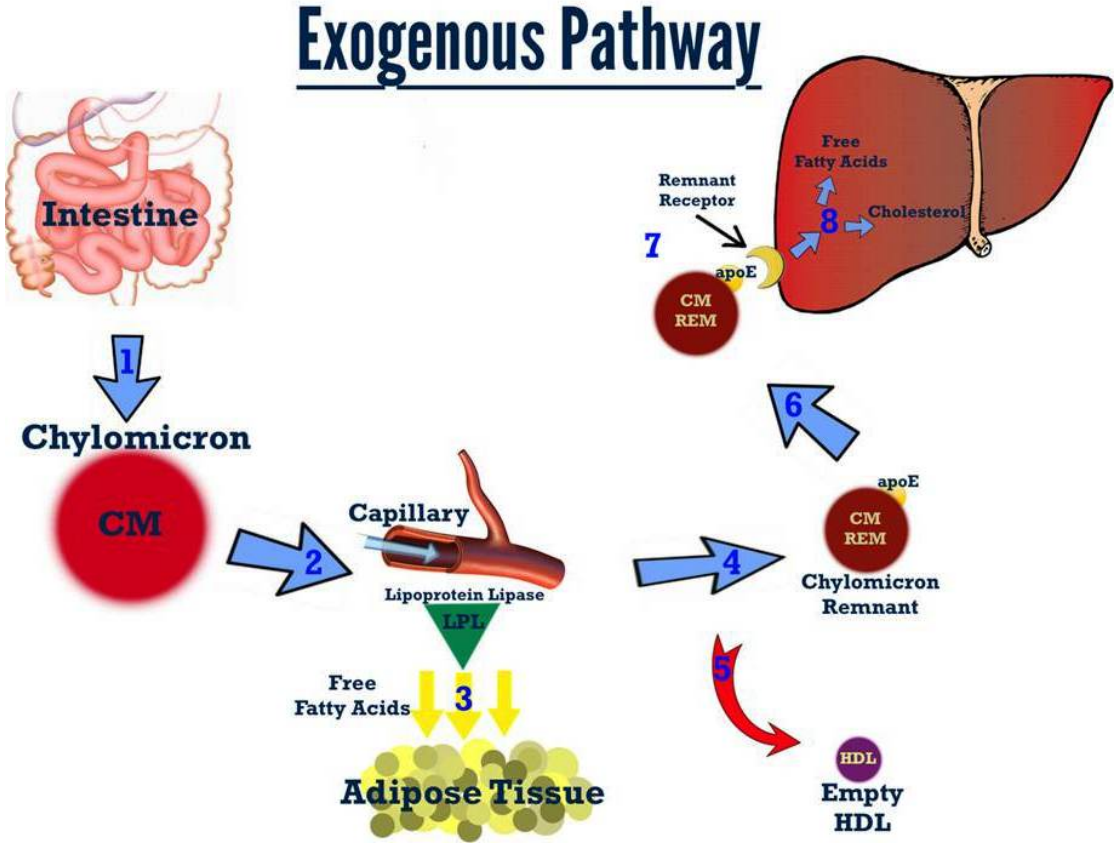
HDL particles transport cholesterol from peripheral tissues to the liver. This transport is called as reverse cholesterol transport.

5. FREE FATTY ACIDS: They are in the circulation as a bound form to albumin and this lipoprotein cannot be separated by electrophoresis.

Classification of Lipoproteins:

Lipoprotein	**Density g/ml**	**Size nm**	**Electrophoretic pattern mobility**	**Major apoproteins**	**Other apoproteins**
Chylomicrons	0.93	75-1200	Origin	Apo B-48	A-1, A-IV, C-I, C-II, C-III
Chylomicron remnants	0.930-1.006	30-80	Slow pre-β	Apo B-48	E, A-I, A-IV, C- I, C-II, C-III
VLDL	0.930-1.006	30-80	Pre-β	Apo B-100	E, A-I, A-II, A-V, C-I, C-II, C-III
IDL	1.006-1.019	25-35	Slow pre-β	Apo B-100	E, C-I, C-II, C-III
LDL	1.019-1.063	18-25	β	Apo B-100	
HDL	1.063-1.210	5-12	alpha	Apo A-I	A-II, A-IV, E, CIII

Transport of dietary lipids: (exogenous pathway)



In the intestine, triglycerides are acted upon by lipases and emulsified with bile acids to form micelles.

Chylomicrons are formed by packaging of triglycerides, cholesteryl esters, cholesterol and retinyl esters along with ApoB48. This nascent chylomicrons are secreted into the intestinal lymph and from there, they directly enter the blood circulation through the thoracic duct.

The chylomicron particles are metabolized by lipoprotein lipase (LPL), which are present over the capillary endothelial walls of adipose

tissue, heart and skeletal muscle. During the metabolism of triglycerides by the lipoprotein lipase free fatty acids are released.

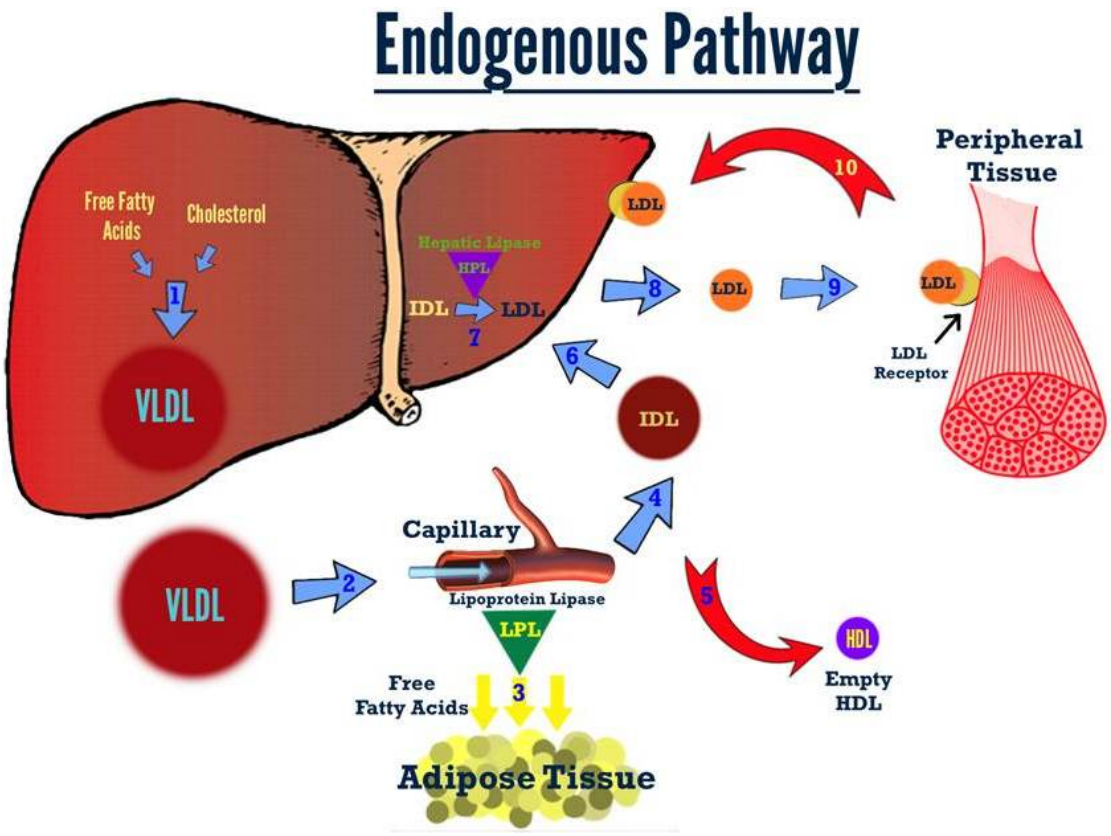
ApoCII is the co-factor for the lipoprotein lipase which is transferred to the chylomicrons from the HDL. After the metabolism by the lipoprotein lipase the chylomicrons progressively shrinks in size and are called chylomicron remnants. The cholesterol ester and triglycerides are hydrolysed and the cholesterol, phospholipids, apoproteins C and E are transferred to the HDL.

Finally chylomicron remnants are taken up by the liver, where apoE acts as a ligand for LDL receptors in the liver. So usually chylomicrons or chylomicron remnants are cleared from the circulation within 12 hours.

Transport of hepatic lipids: (endogenous pathway)[33]

VLDL particles have ApoB100 as co-factor and they have higher ratio of cholesterol to triglyceride as compared to that of the chylomicrons.

VLDL is formed by the packaging of ApoB100,cholesteryl esters and phospholipids. This packaging of nascent chylomicron requires microsomal triglyceride transfer protein (MTP)[34].

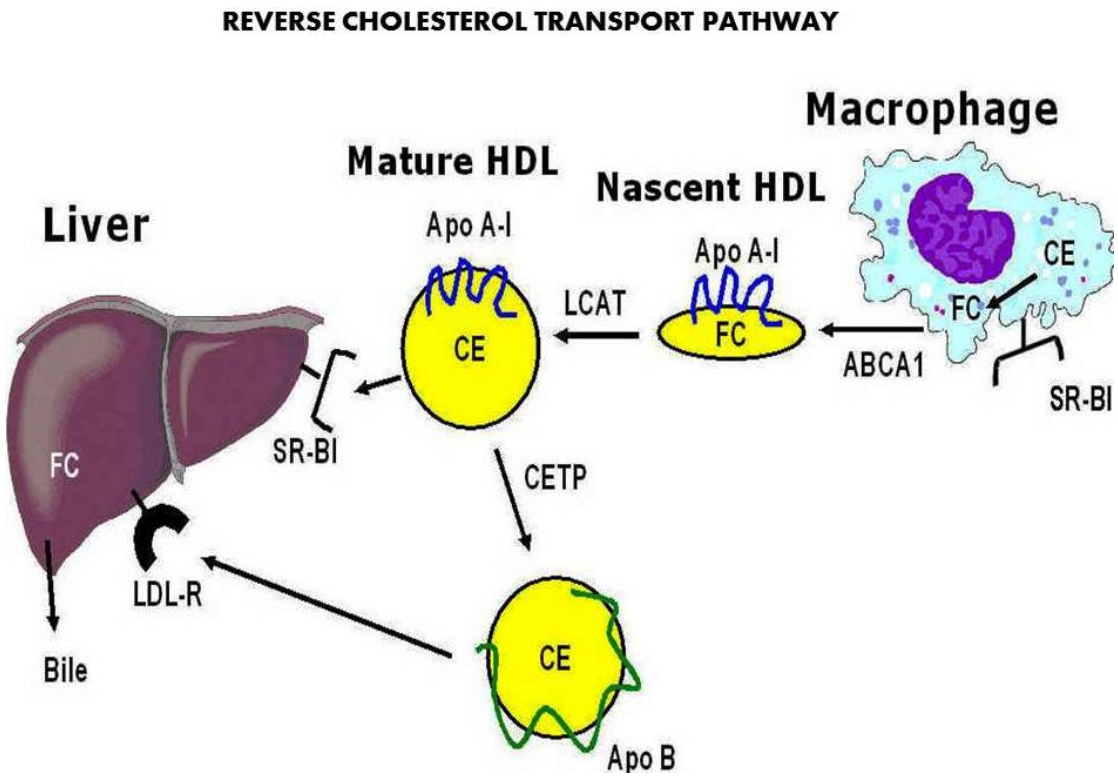


VLDL are metabolised by the lipoprotein lipase[35] present in the muscle and adipose tissue.

VLDL is the precursor of IDL and, from IDL, VLDL is formed. Each LDL is derived from only one VLDL because the apoprotein of VLDL, ApoB100 is conserved during this transformation.

IDL can enter two sets of metabolism, either it can be taken up by the liver, directly through the LDL receptors[36] or, it can be metabolized by lipoprotein lipase and form LDL.

HDL Metabolism and Reverse Cholesterol Transport:



HDL is synthesized and secreted by the liver. Nascent HDL is discoidal shaped and it consists of phospholipid, cholesterol and ApoA. A plasma enzyme Lecithin: Choleserolacyltransferase(LCAT) gets attached to the disk and subsequently ApoA1, the activator of LCAT, binds to LCAT. This binding is responsible for the conversion of phospholipids and cholesterol into lysolecithin and cholesteryl esters, respectively.

Lysolecithin is transferred to plasma albumin and cholesteryl ester being nonpolar is moved into the interior, from the surface. In this process, HDL becomes spherical, containing polar lipids and apoproteins.

Thus, LCATsystem helps in the transport of unesterified cholesterol from lipoproteins and tissues.

The class B scavenger receptor B1(SR-B1) is identified as the HDL receptor in the liver. ApoA1 binds to the SR-B1 and the cholesteryl esters are delivered to the liver cells and apo A1 is released in the process to form pre β HDL, the most potent form of HDL.

This transport of cholesterol from the tissues to the liver is known as reverse cholesterol transport.

LIPID PROFILE IN CHRONIC RENAL FAILURE

ALTERATION OF LIPIDS AND LIPOPROTEINS IN CKD

Quantitative changes in the lipid pattern.

Plasma triglycerides are elevated, because of

- Decreased clearance of VLDL from the plasma and decreased clearance of the IDL.
- Decreased clearance of chylomicrons from the plasma.

Plasma cholesterol is normal or reduced , but occasionaly in cases of ESRD, plasma cholesterol levels may be increased

Plasma LDL levels are usually normal or may be occasionally increased in ESRD.

Plasma HDL is consistently reduced

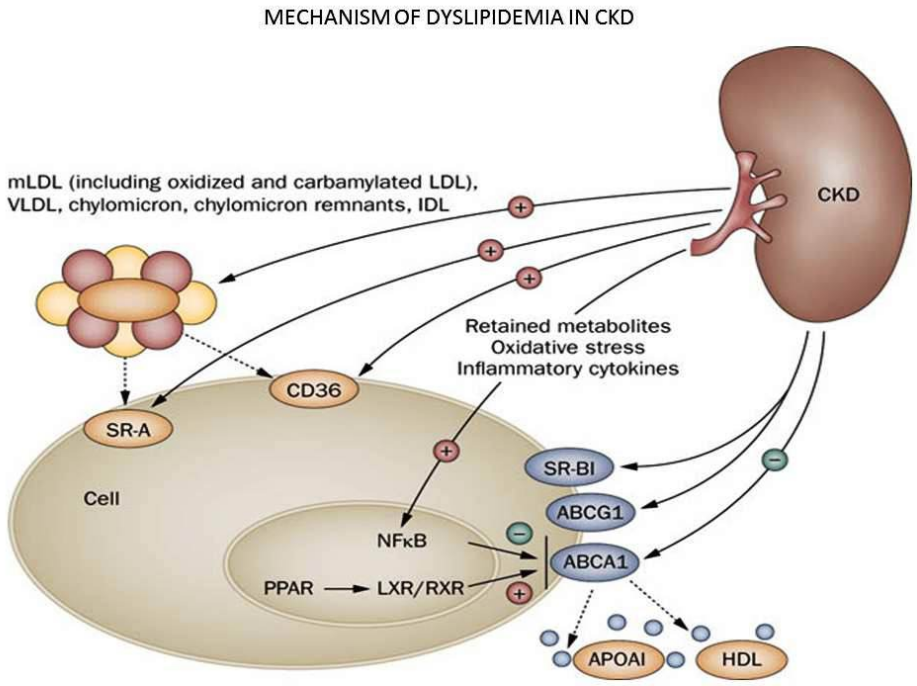
HDL-3 To HDL-2 ratio is impaired in Chronic kidney disease[39,40,41,42,43,44,45].

Altered composition of lipoproteins.[39,41,42,43]

In VLDL, its cholesterol content is relatively increased and the triglyceride is relatively decreased.

In LDL, its cholesterol content is relatively decreased and the triglyceride is relatively increased , in contrast to that of the VLDL.

In HDL, its cholesterol content is relatively decreased, its cholesteryl ester content is relatively decreased whereas, its triglyceride content is relatively increased. This changes indicates the redistribution of cholesterol from HDL to VLDL and IDL, defective removal of triglycerides from HDL and LDL.



Alteration of apoprotein levels.[39]

Decreased levels of Apo AI and Apo AII

Decreased levels of Apo E

Increased levels of Apo CIII

Decreased ratio of Apo CII to Apo CII.

These apoprotein changes are believed to be the reasons, for the possible changes in lipid profile of the chronic kidney disease, because the changes in apoproteins precedes that of the lipid changes in early renal insufficiency.[39]

PLASMA LIPID AND LIPOPROTEIN CHANGES IN CHRONIC KIDNEY DISEASE

PROTEIN	CHANGE	EFFECT ON PLASMA LIPIDS/ LPs	
Apo AI	↓	↓ HDL	
LCAT	↓	↓HDL Ch	↓ HDL-2/HDL-3
CETP	↑	↓HDL Ch	↑ HDL-TG
ACAT	↑	↑VLDL Ch	↓HDL Ch
LPL	↓	↑ TG	
VLDL receptor	↓	↑ VLDL	↑TG
HEPATIC LIPASE	↓	↑ IDL ↑TG ↑ HDL-TG ↑LDL-TG	
LRP	↓	↑IDL	↑ CM remnants
ApoCII/CIII	↓	↑TG	
Preβ HDL	↑	↑TG	
HEPATIC DGAT	↓	↓ VLDL-TG	

ALTERATION OF THE HDL METABOLISM IN CHRONIC KIDNEY DISEASE

HDL levels are decreased in chronic renal failure with alteration in composition of HDL by increase in triglyceride level and decrease in cholesterol level.

This abnormalities are due to dysregulation of the following proteins,

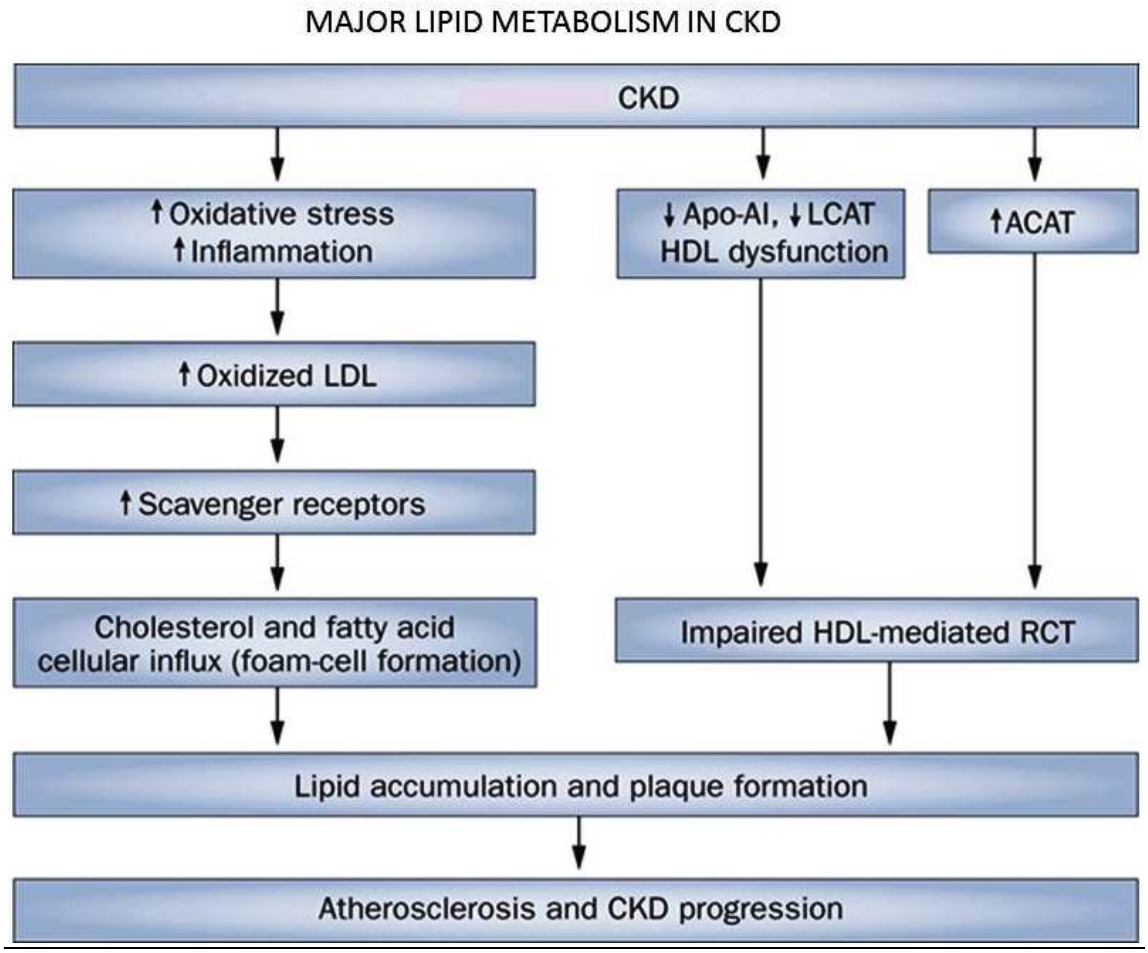
Apo AI and ApoAII[50] : Their levels are reduced in chronic renal failure and the possible reason for the reduction is downregulation of ApoAI gene expression.

This proteins being the structural constituents of the HDL, decrease in their levels lead to decrease in the levels of the HDL[46].

LCAT: Their levels are consistently decreased in chronic kidney disease[47,48,44].

The reason for the decreased levels of LCAT in chronic kidney disease are,

- decreased hepatic production
- inhibition by unknown uremic toxin



CETP: Their levels are increased in chronic kidney disease.

Proteinuria increases the level of CETP[49,50]

SRB-1: They are useful in transport of HDL containing cholesteryl esters and triglycerides

In chronic renal failure, SRB-1 expression is dysregulated[51,46].

ACAT: It is the enzyme for esterification of intracellular cholesterol, but HDL cholesterol transport from the peripheral tissues depend on the deeseterification of the cholesteryl esters[52].

In chronic kidney disease, ACAT-2 levels are found to be increased which can decrease the levels of HDL in the plasma

METABOLISM OF TRIGLYCERIDES IN CHRONIC RENAL FAILURE[39,41,57]

I. Decreased Catabolism

A. Decreased activity of lipolytic enzymes

1. Lipoprotein lipase due to

- Insulin deficiency
- Inhibitors in uraemic plasma
- Reduced apo C-II/apo C-III ratio

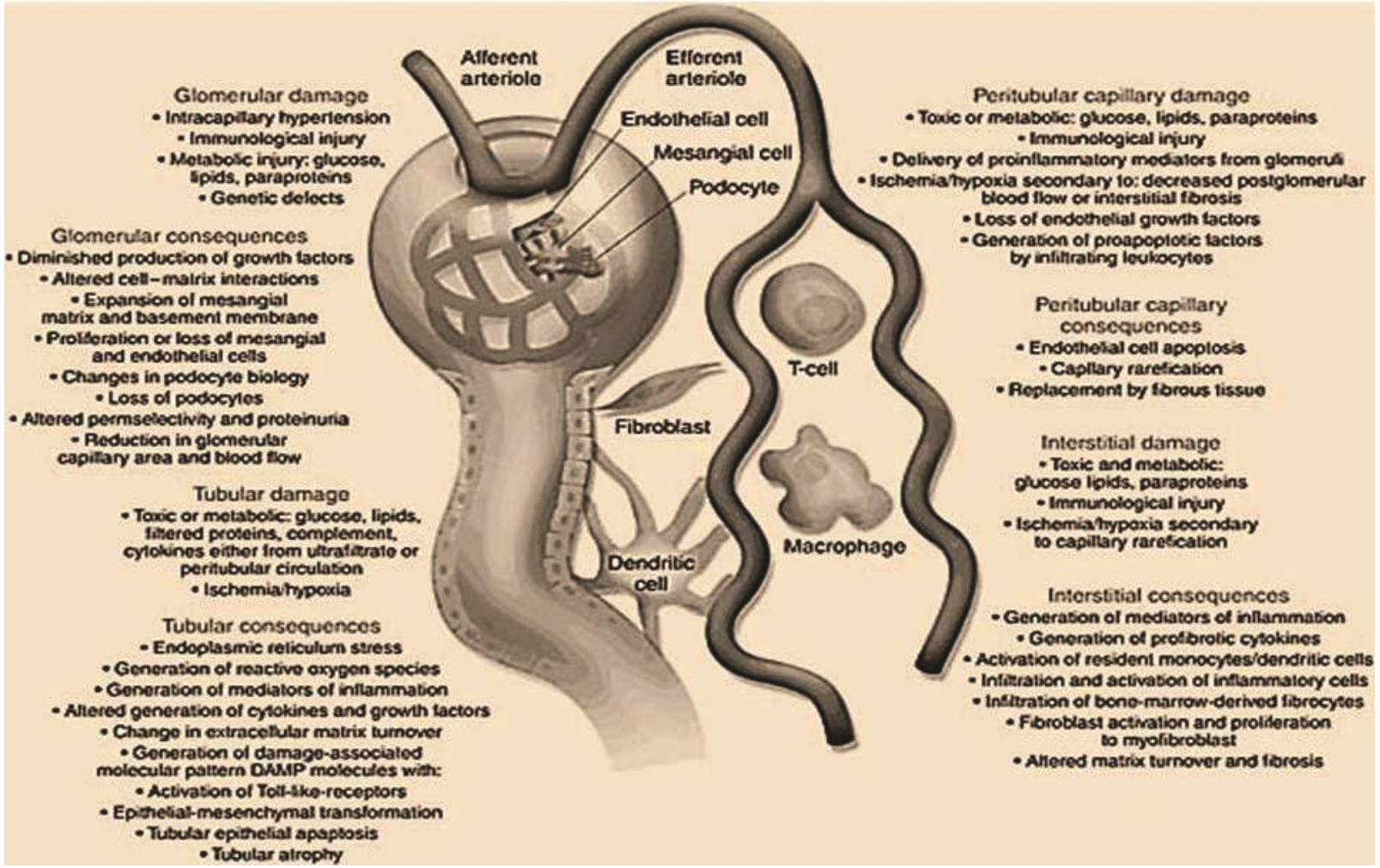
2. Hepatic Triglyceride lipase.

3. Lecithin cholesterol acyl transferase (LCAT)

B. Alteration of lipoprotein substrate

C. Decreased carnitine level.

PATHOPHYSIOLOGY OF CKD

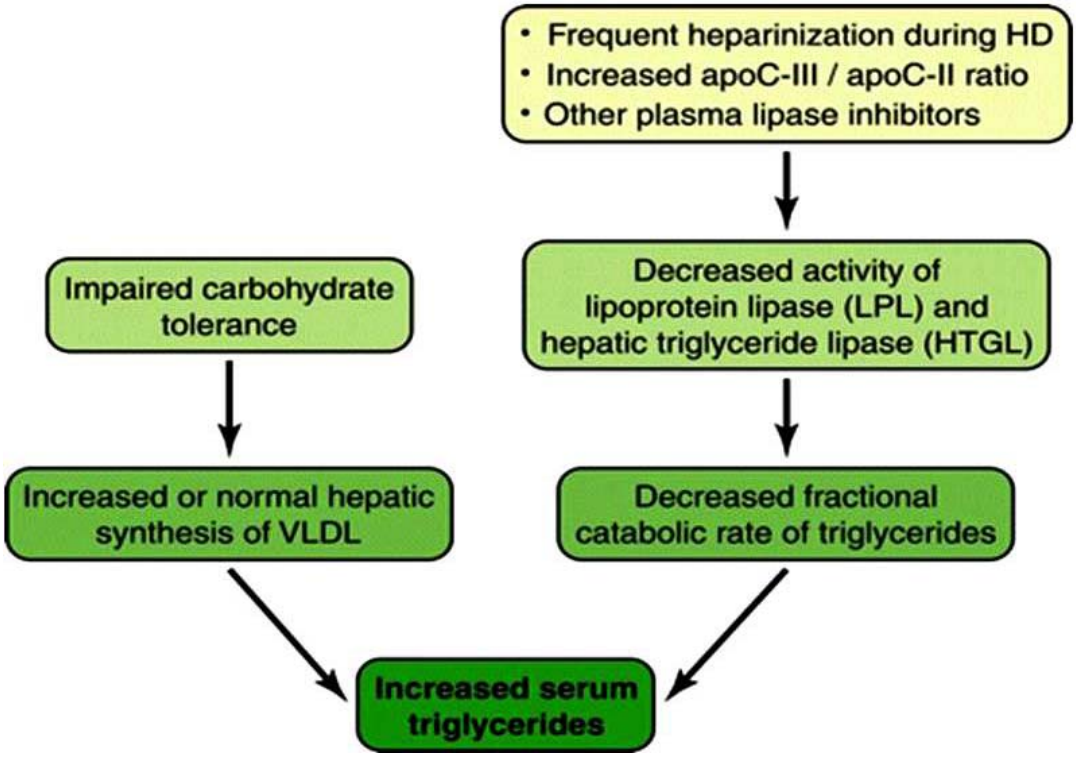


D. Decreased beta oxidation of free fatty acids.

E. Triglyceride enriched LDL

F. Altered apolipoprotein composition

TRIGLYCERIDE METABOLISM IN CKD



II. INCREASED ApoC-III/ApoE In IDL, LDL

III. INCREASED TRIGLYCERIDE PRODUCTION

- Increased dietary carbohydrates
- Uptake from glucose due to immune resistance to insulin[45,]
- Hyperinsulinemia

METABOLISOM OF CHOLESTEROL IN CHRONIC RENAL FAILURE:

Plasma cholesterol levels are normal or decreased but occasionally can be increased.

Synthesis of cholesterol: HMG CoA reductase is the rate limiting enzyme in the synthesis of cholesterol.

No considerable change in the activity of HMG CoA is found in the chronic kidney disease but, proteinuria can modify HMG CoA expression.[54]

Catabolism of cholesterol: The enzyme 7α reductase is the rate limiting enzyme in the cholesterol conversion to bile acids[55].

The LDL receptor protein levels are not altered in chronic kidney disease, so the LDL receptor mediated cholesterol uptake is not altered. Their levels are not considerably increased in chronic renal failure. It is noted that proteinuria in early renal insufficiency can simulate nephrotic syndrome and can lead onto hypercholesterolemia and increased LDL levels.

CLINICAL SIGNIFICANCE OF RENAL DYSLIPIDEMIA

Cardiovascular disease is the leading cause of death in patients with ESRD and lipid abnormalities present in CRF patients contributing to cardiovascular mortality.[56, 57]

In the Monitored atherosclerosis regression Study (MARS)[58] a number of correlation were found between the markers of Apo B containing lipoproteins and the annualized rate of atherosclerotic change in the distal common carotid artery wall which was determined by high resolution B mode ultra sound.

Progression of common carotid atherosclerosis significantly correlated with the progression of coronary artery disease as measured by quantitative coronary angiography.

The results of MARS study provided further evidence for the impact of triglyceride rich lipoproteins in progression of CAD.

Recent data obtained in hemodialysis patients demonstrated reduced capacity of the HDL to prevent LDL oxidation in vitro.

So combined hyperlipidemia with elevated triglyceride with low HDL cholesterol level reflects probably more atherogenic condition than does isolated elevation of LDL cholesterol.

Small LDL particles present in patient receiving hemodialysis also contributes to cardiovascular mortality.

Lipid abnormalities probably represent one of several potentially correctable cardiovascular risk factors associated with CRF[59,60,61].

DYSLIPIDEMIA AND PROGRESSION OF RENAL DISEASE IN CKD PATIENTS[62,63]

Experimental studies have provided a clear link between hyperlipidemia and kidney damage in animals but there is only limited evidence to suggest that, lipids contribute to progression of renal disease in man.

Lipid abnormalities directly contribute to glomerelosclerosis and tubulointerstitial injury and that correction of lipid abnormalities associated with renal disease will slow the progression of CRF.

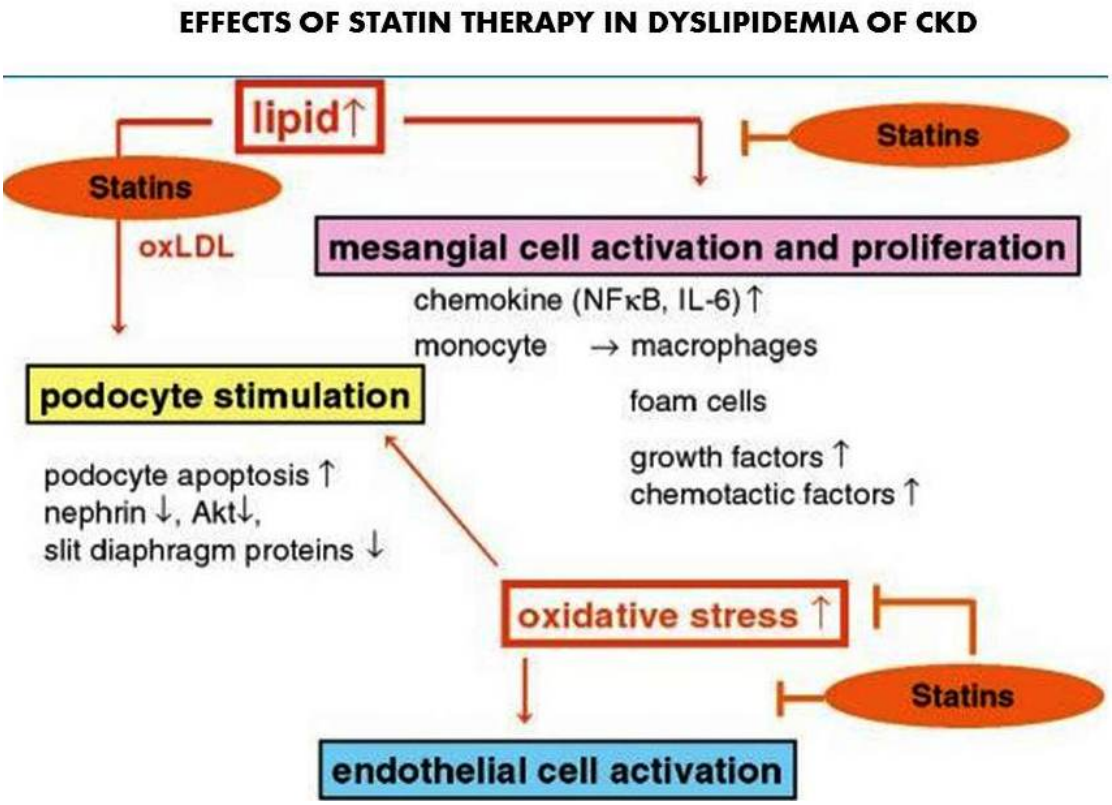
TREATMENT OF DYSLIPIDEMIA IN CKD

Rationale for lipid lowering treatment in ESRD[61].

The quantities of abnormal lipoprotein particles in uremia and their associated coronary disease are underestimated by conventional cholesterol measurement.

Beneficial effects of lipid lowering therapy in ESRD are likely but the effectiveness of lipid lowering on the reduction of cardiovascular end points remain elusive

Statins: These drugs are shown to be highly effective in reducing LDL cholesterol concentrations in both diabetic and non-diabetic patients with CRF. Statins also lower the levels of atherogenic IDL[64].



A meta analysis of four randomized trials[65,66]such as, 4S, CARE, AFCAPS/ Tex CAPS, [67] comparing HMG – COA reductase inhibitors to control included , 817 participants found that, HMG-COA reductase inhibitor treatment was associated with,

1) 20% decrease in total cholesterol, 5% increase in HDL cholesterol, 28% decrease in LDL cholesterol and 13% decrease in triglycerides.

2) 31% decrease in major coronary events and a 21% decrease in all cause mortality.

3) Similar risk reduction in women and men.

Unexpectedly the risk of stroke was also reduced by 19-32% by HMG-COA reductase inhibitor treatment.

Fibric Acid Derivatives : These drugs improve lipoprotein lipase activity and inhibit hepatic synthesis of VLDL cholesterol, resulting in reduction of triglyceride and an increase in HDL cholesterol[68].

Lipid lowering therapy in patients with renal insufficiency may help to slow the rate of renal disease progression and reduces the risk of cardiovascular mortality and morbidity.

TREATMENT STRATEGY IN STAGE V CKD*:*

For adults with stage V CKD and fasting triglyceride > 500mg/dl, that cannot be corrected by removing an underlying cause, treatment with

therapeutic life style changes and triglyceride lowering agent should be considered.

For adults with stage V CKD and LDL ≥ 100 mg/dl treatment should be considered to reduced LDL < 100 mg/dl.

For adults with stage V CKD and non-HDL cholesterol ≥ 130 mg/dl, treatment should be considered to reduce non-HDL cholesterol to <130 mg/dl.

The National kidney foundation task force on CVD concluded that the incidence of ACVD is higher in patients with CKD compared to the general population. The task force concluded that patient with CKD should be considered to be in the highest risk category i.e. CHD risk equivalent, for risk factor management.

MATERIALS AND METHODS:

Setting

The study was conducted in Government Mohan Kumaramangalam Medical College, Salem.

Study Design:

Cross- sectional study.

Period of Study

July 2010 to June 2012

Sample Size:

50 Cases; 50 Controls

Study Population:

Patients admitted in medicine wards of Government Mohan Kumaramangalam Medical College, Salem.

Ethical Committee Clearance: Obtained

Conflict Of Interest: Nil

Financial Support: Nil

Case Definition:

Chronic kidney disease5

- Kidney damage for ≥ 3 months as defined by structural or functional abnormalities of the kidney, with or without decreased GFR manifested by either,

Pathological abnormalities or,

Markers of kidney damage including abnormalities in the composition of the blood or urine or abnormalities in imaging tests.

- GFR < 60ml/min/1.73m2 for ≥ 3 months, with or without kidney damage.

The presence of chronic kidney disease should be established based on presence of kidney damage and level of kidney function (glomerular filtration rate), irrespective of diagnosis.

Among patients with CKD the stage of disease should be assigned based on the level of kidney function, irrespective of the diagnosis according to the KDOQI CKD classification.

Stages of the CKD:

Stage	Description.	GFR ml/min /1.73m^2
1	Kidney damage with normal or ↑GFR	> 90
2	Kidney damage with mild ↓GFR	60-89
3	Moderate ↓GFR	30-59
4	Severe ↓GFR	15-29
5	Established Renal Failure	<15(or dialysis)

The cases are diagnosed with the help of the following criteria:

Clinical Criteria:

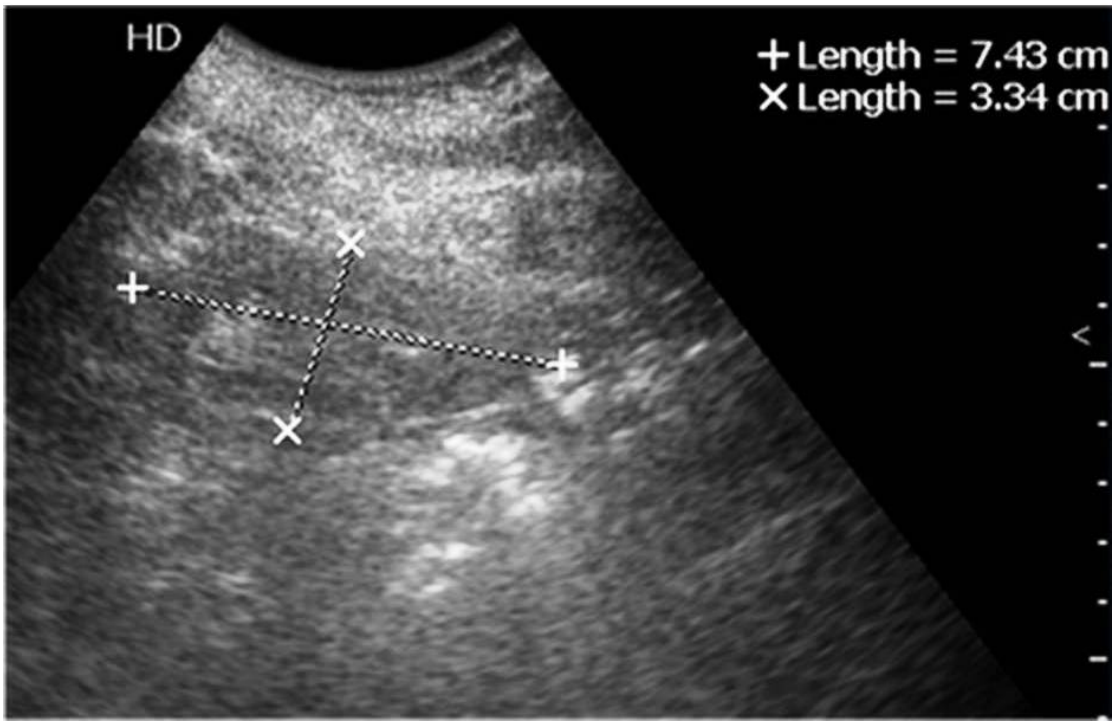
- Anaemia of chronic renal failure
- Hypertension
- Uremic symptoms – Three months duration

Biochemical Criteria:

- Elevated blood urea & serum Creatinine

Ultra sonographic Criteria:

UTRASOUND SHOWING SHRUNKEN KIDNEY IN CKD



- Contracted kidney
- Increased cortical echogenicity
- Loss of cortico- medullary differentiation

Inclusion Criteria:

- Patients between age group of 15 to 80 years with chronic kidney disease.
- Patients with established chronic kidney disease were selected irrespective of the etiology.

- Established chronic kidney disease was ensured by radiological evidence or biochemical evidence for more than 3 months

Exclusion Criteria:

- Patients with known h/o diabetes mellitus and patients with Diabetic kidney disease , with elevated random blood sugar values of >200mg% were excluded.

- Ischemic heart disease on treatment already, were excluded.
- Severe comorbid conditions like pneumonia, alcoholic Liver disease and hypotension were excluded.
- Those who are taking Beta blocker and thiazide diuretics at time of study were excluded.
- Patients with H/o intake of anti cholesterolemic agentswere excluded.
- Patients with H/O cigarette smokingwere excluded.
- Patients with the features of hypothyroidism and obstructive Liver disease were excluded.
- Patients with previous H/o hemodialysis and peritoneal dialysis were excluded.

Controls:

Age matched and sex matched 50 non- smoking healthy volunteers

Methods:

Both cases and controls are evauated with:

- Clinical history and physical examination
- Blood- urine, sugar
- Serum creatinine
- Urine routine
- Complete blood count
- X ray chest PA view
- USG abdomen
- Serum fasting lipid profile
- ECG

Lipid profile:

Blood samples were obtained on one occasion from antecubital venepuncture after an overnight fast (12hrs) from all patients.

- Triglycerides were estimated by enzymatic colorimetric method.
- TC was estimated using enzymatic method.
- HDL was estimated by phosphotungstate method.
- LDL cholesterol was calculated by Friedewald's equation.

LDL = TC – triglycerides/ 5 - HDL

AccordingtoNationalCholesterolTreatmentProgramAdultTreatment PanelIIIguidelines,

Lipid classification according to ATP III[38]

Lipoproteins Levels	Category
LDL –C (mg/dl)	
< 100	Optimal
100-129	Near or above optimal
130-159	Borderline high
160-189	High
>190	Very high

Lipoproteins Levels	Category
Total cholesterol (mg/dl)	
< 200	Desirable
200-239	Borderline high
> 240	High
HDL – C (mg/dl)	
< 40	Low
≥60	High
Triglycerides(mg/dl)	
< 150	Normal
150-199	Border line high
200-499	High
>500	Very high

And the normal values of lipoproteins according to ATP III classification are,

LDL cholesterol <130mg/dl (with 2+ risk factors)

HDL cholesterol >40 mg/dl

Triglycerides <150 mg/dl

Total cholesterol <200 mg/dl.

Statistical Analysis

The data were analysis using SPSS (Statistical Package for Social Science) Ver 16.01. The data collected were scored and analyzed, Continues variables were presented as means with Standard deviation (sd) and categorical variables were presented as frequency and percentages. Student t-test and analysis of variance (ANOVA) were used for testing the significance of all the variables (Mean & Sd) in both the group. Chi-square test was used to compare proportions. All the Statistical results were considered significant at P value < 0.05.

OBSERVATION AND RESULTS

Table - 1 : Age Distribution among Cases and Controls

Age Group (in Years)	**CASE**		**CONTROL**	
	Number	**%**	**Number**	**%**
15 -25	3	6.00	0	0
25-35	5	10.00	0	0
35-45	13	26.00	4	8.00
45-55	12	24.00	39	78.00
55-65	15	30.00	7	14.00
65-75	2	4.00	0	0
Mean±sd	48.38 ± 13.05		51.66 ± 4.14	
t-value	1.69			
Df	98			
p-value	0.09 (Not Significant)			

The mean age of the patients were 48.3 years and mean age of the controls were 51.6years.There was no significant difference between the study cases and controls in the age. p value (0.09) not significant, hence they are comparable.

Chart - 1 : Age Distribution among Cases and Controls

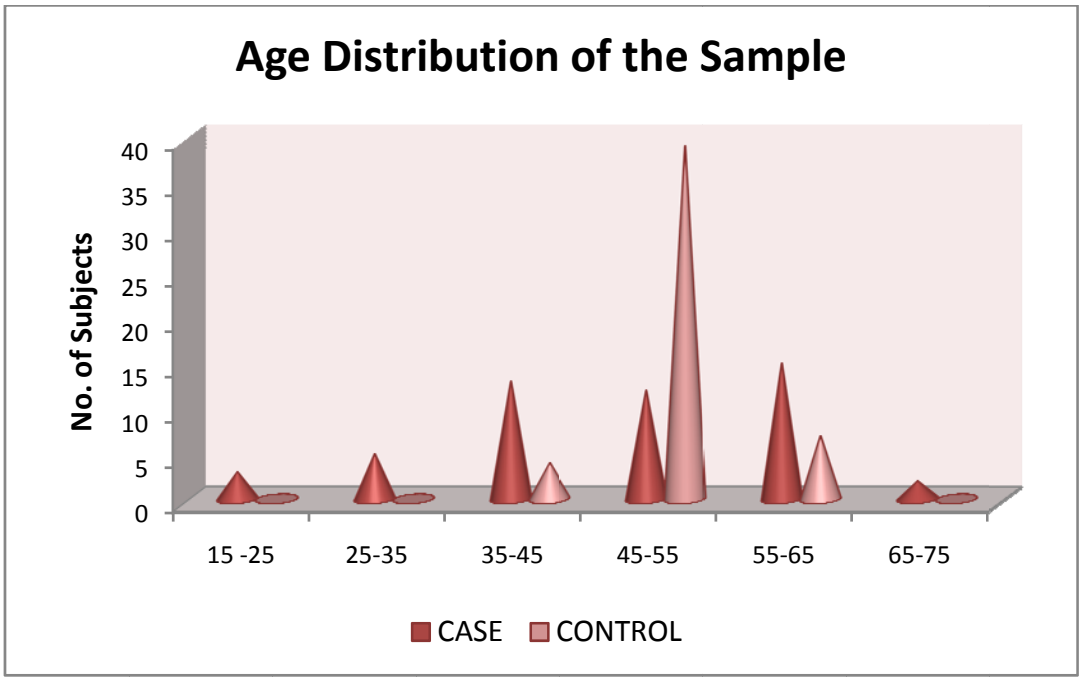


Table - 2 : Sex distribution among Cases and Controls

Sex	CASE		CONTROL	
	Number	**%**	**Number**	**%**
Male	33	66.00	30	60.00
Female	17	34.00	20	40.00
Total	50	100	50	100
Chi-square value	0.39			
Df	1			
(p value)	0.53 (Not Significant)			

There was no significant difference between study group and controls regarding the sex distribution, p value (0.53). Hence they are comparable.

Chart - 2 : Sex distribution among Cases and Controls

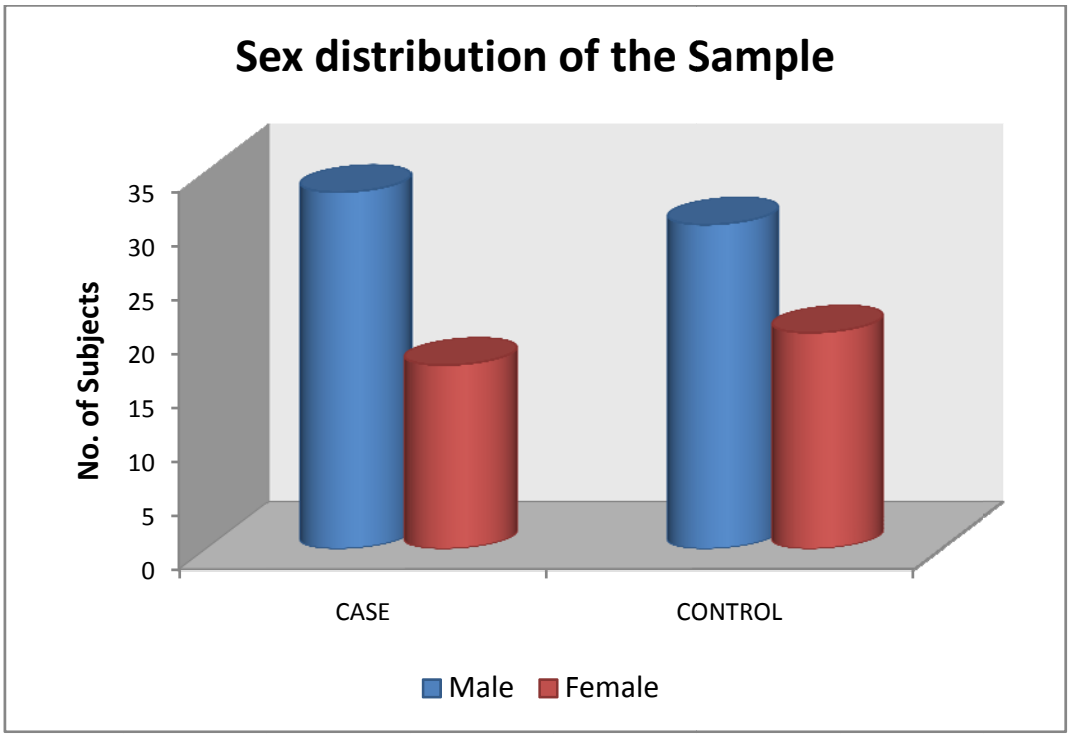


Table - 3 : Distribution of HDL among Cases and Controls

HDL	CASE	CONTROL
Mean	38.86	54.04
Sd	8.04	10.74
Range	24 - 57	37 - 78
t-Value	8.00	
Df	98	
p-value	0.000 (Significant)	

In our study, HDL showed a significant reduction in CRF cases, compared with controls. The mean HDL in cases were 38.8 mg/dl and 54 mg/dl in controls. The difference was statistically significant with a p value of 0.0001.

Chart - 3 : Distribution of HDL among Cases and Controls

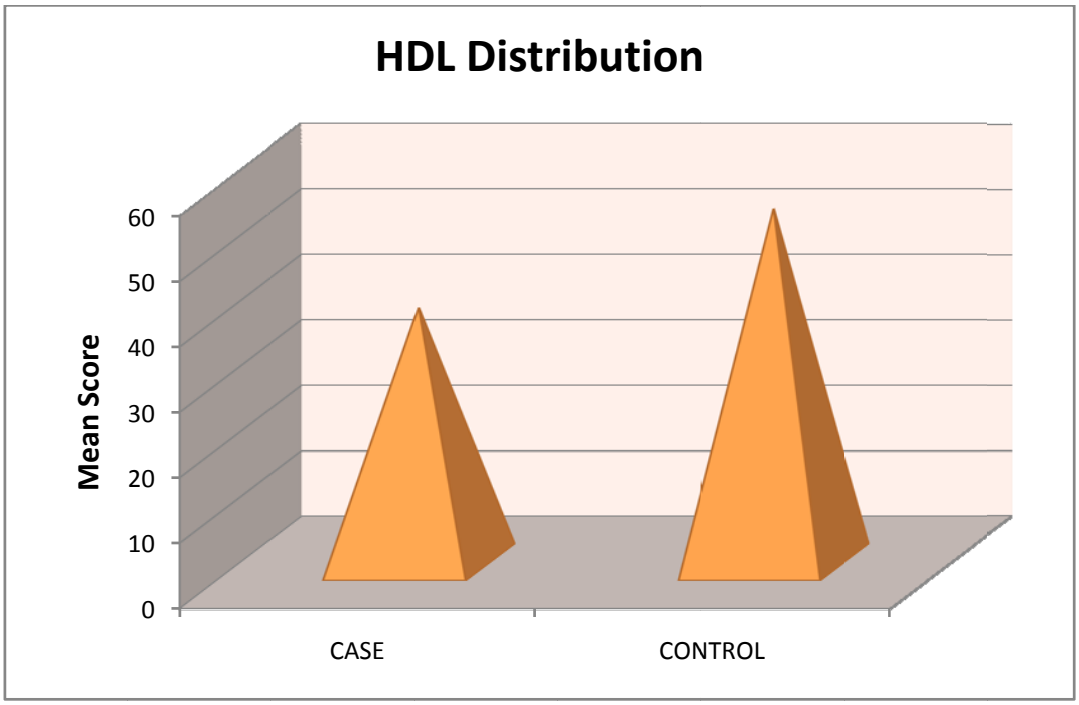


Table - 4 : Distribution of LDL among Cases and Controls

LDL	CASE	CONTROL
Mean	110.08	101.62
Sd	45.10	23.76
Range	38 - 217	50 - 155
t-Value	1.17	
Df	98	
p-value	0.24 (Not Significant)	

LDL Cholesterol was high in cases, compared to controls, but the difference was not significant statistically. The mean LDL in cases was 110 mg/dl and 101.6 mg/dl in controls. The p value was (0.24), not significant.

Chart - 4 : Distribution of LDL among Cases and Controls

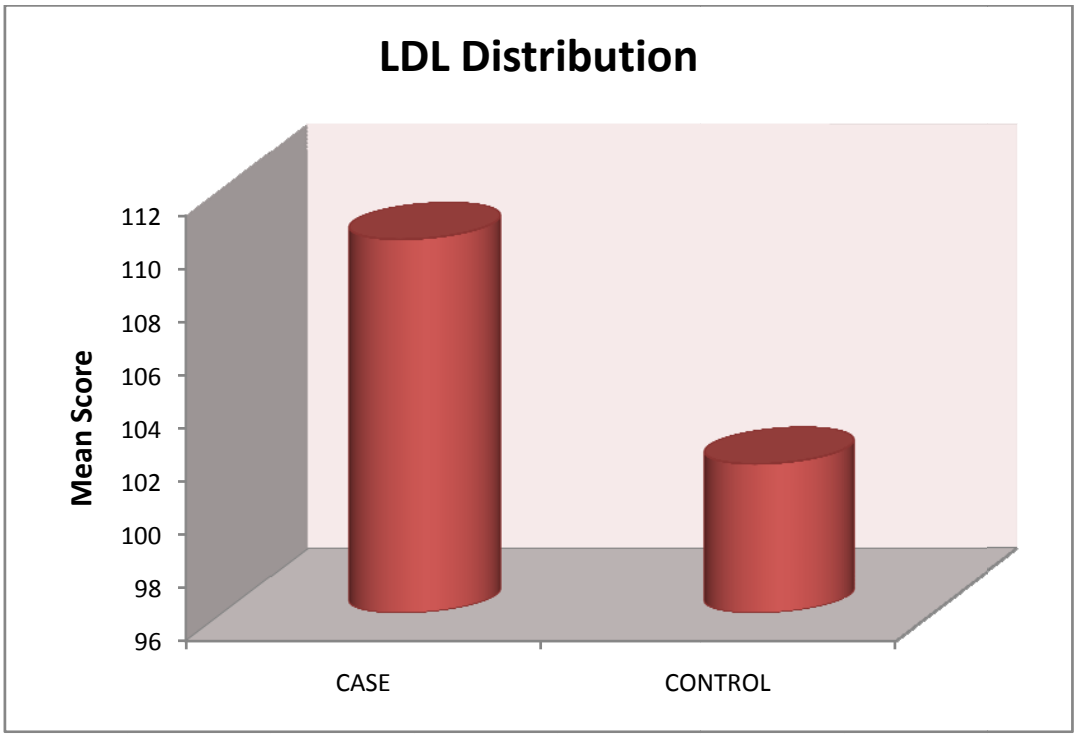


Table - 5 : Distribution of TGL among Cases and Controls

TGL	CASE	CONTROL
Mean	147.68	127.86
Sd	61.57	27.23
Range	36 - 278	72 – 212
t-Value	2.09	
Df	98	
p-value	0.04 (Significant)	

In our study, triglyceride showed a significant increase in CRF cases, compared with controls. The mean triglyceride in cases were 147.6 mg/dl and 127.8 mg/dl in controls. The difference was statistically significant with a p value (0.04).

Chart - 5 : Distribution of TGL among Cases and Controls

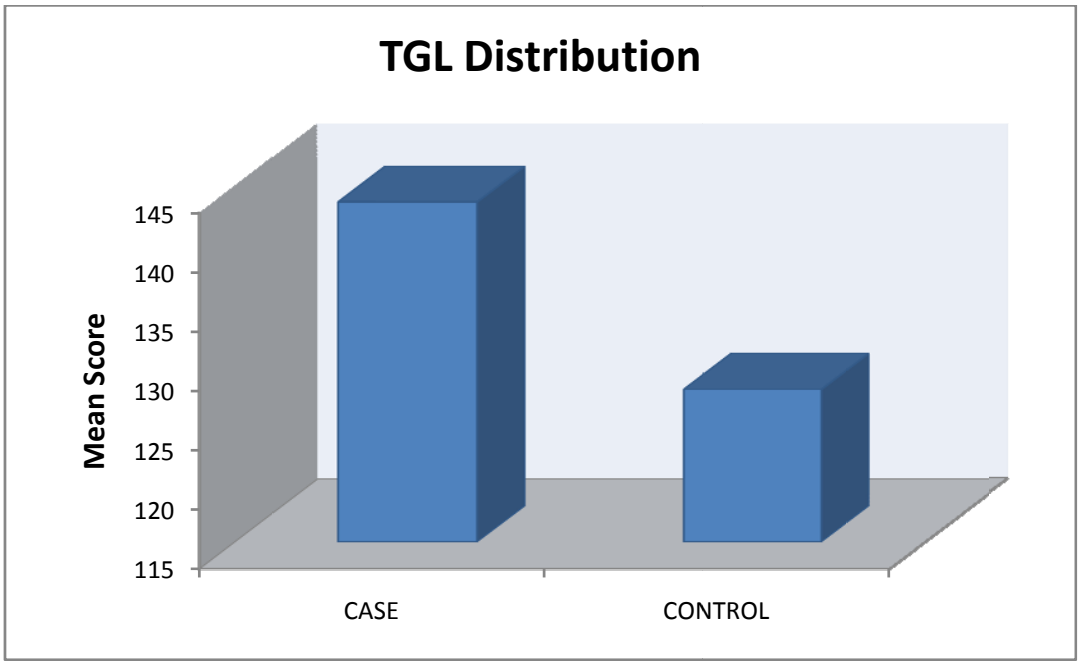


Table - 6 : Distribution of TC among Cases and Controls

TC	CASE	CONTROL
Mean	164.02	176.34
Sd	39.90	24.37
Range	72 -263	90 - 231
t-Value	1.86	
Df	98	
p-value	0.07 (Not Significant)	

Total Cholesterol was decreased in cases compared to controls, but the difference was not significant statistically. The mean Cholesterol in cases was 164mg/dl and176.3 mg/dl in controls. The p value (0.07) was not significant.

Chart - 6 : Distribution of TC among Cases and Controls

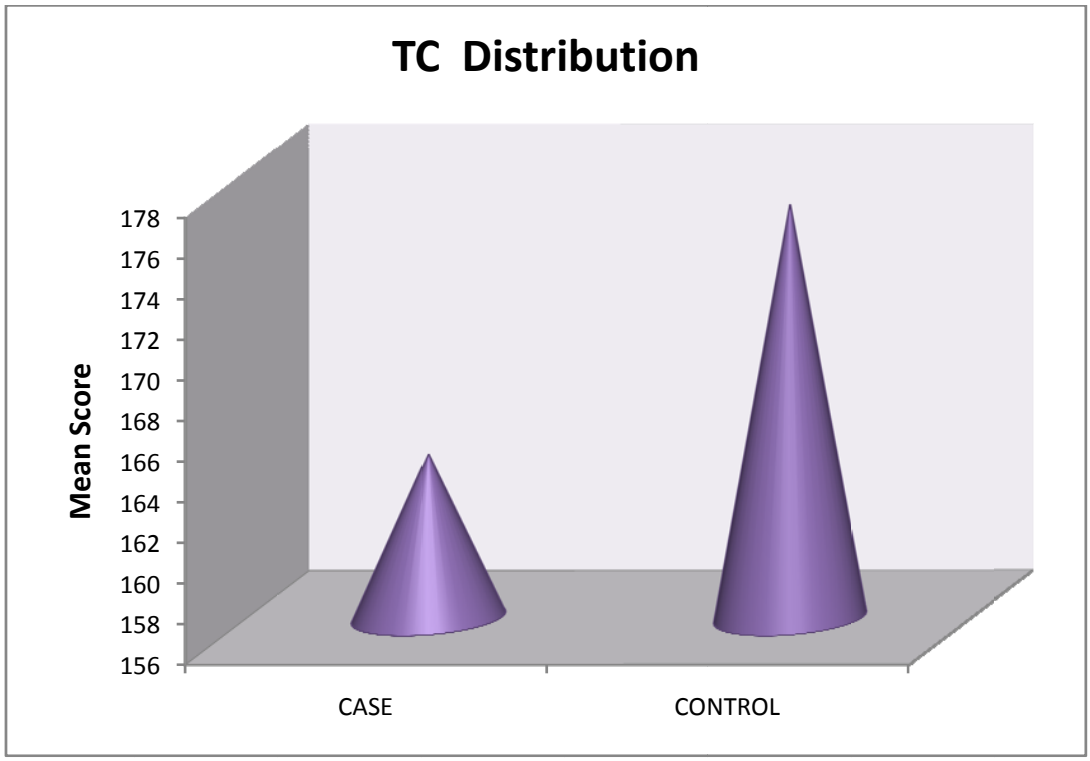


Table - 7 : Distribution of TC/HDL among Cases and Controls

TC/HDL	CASE	CONTROL
Mean	4.33	3.42
Sd	1.09	0.95
Range	1.57 – 7.07	1.50 - 5.51
t-Value	4.46	
Df	98	
p-value	0.000 (Significant)	

Total Cholesterol /HDL ratio was increased in cases compared to controls, and the difference was significant statistically. The mean Total Cholesterol/HDL ratio was 4.3 in cases and 3.4 in controls. The p value (0.0001) was significant**.**

Chart - 7 : Distribution of TC/HDL among Cases and Controls

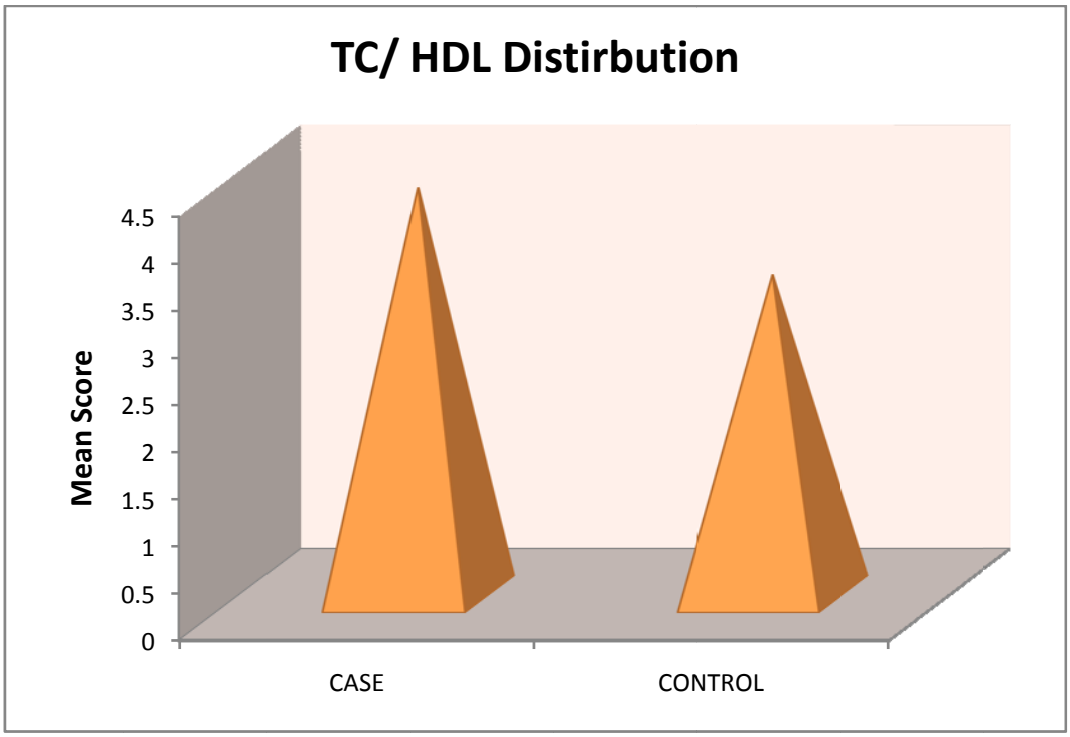


Table - 8 :

Sexwise percentage distribution of staging of kidney diseases.

Staging	Male		Female		Total	
	Number	**%**	**Number**	**%**	**Number**	**%**
III	7	21.20	1	5.80	8	16.00
IV	12	36.40	8	47.10	20	40.00
V	14	42.40	8	47.10	22	44.00
Total	33	100	17	100	50	100
Chi-square	2.02					
Df	2					
p-value	0.364 (Not Significant)					

The above table, shows the sexwise relation of the stages of CKD patients. Since there were no study group belong to stage I and stage II they were not included in the table. Among the three stages the sex differences were not statistically significant (P>0.05). Among the total cases, the stage V had more patients than other 2 stages.

Chart - 8 :

Sexwise percentage distribution of staging of kidney diseases.

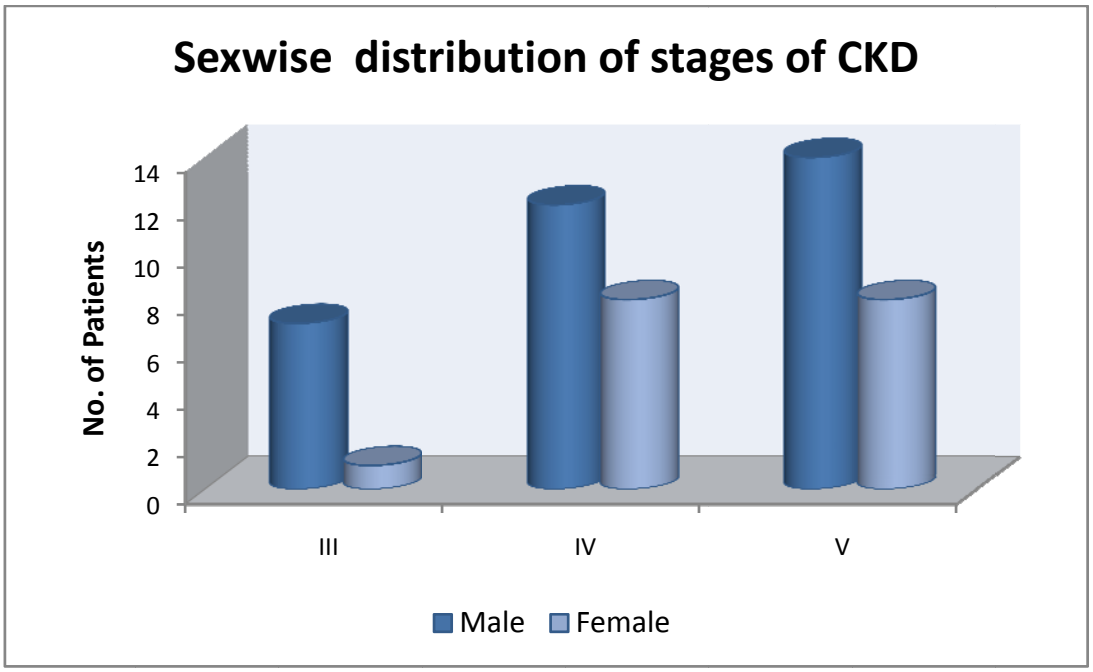


Table - 9 : Stagewise comparison of C.K.D. and lipid abnormalities

Variable	Stages	N	Mean	Sd	F-value	p-value
HDL	3	8	38.38	8.38	0.10	0.90 *
	4	20	38.40	7.46		
	5	22	39.45	8.74		
LDL	3	8	111.75	37.40	0.11	0.90*
	4	20	106.45	55.53		
	5	22	112.77	45.09		
TGL	3	8	121.88	33.66	0.86	0.43*
	4	20	154.80	62.31		
	5	22	150.59	67.85		
TC	3	8	156.75	37.84	0.23	0.79*
	4	20	162.80	45.55		
	5	22	167.77	36.37		
TC/HDL	3	8	4.08	0.43	0.24	0.79*
	4	20	4.36	1.32		
	5	22	4.37	1.04		

*Not significant

The mean HDL in stage III, IV, V patients were 38.38, 38.4, 39.45 respectively and their S.D. are 8.3, 7.4, 8.7 respectively. The mean LDL in stage III, IV, V patient are 111.7, 106.4, 112.8 respectively and their S.D. were 37.4, 55.5, 45 respectively. The mean TGL value in stage III, IV, V were 121.8, 154.8, 150.5 respectively and their S.D were 33.6, 62.3, 67.8. The mean TC in stage III, IV, V patient were 156.7, 162.8, 167.7 respectively and their standard deviation were 37.8, 45.5, 36.3. The mean TC/HDL ratio in stages III, IV, V were 4, 4.3, 4.3 respectively and standard deviation were 0.4, 1.3, 1.4. From this table, the HDL, TGL, LDL, TC, TC/HDL ratio value in stages III, IV, V of CKD are not statistically significant ($P>0.05$).

In other words, the intergroup variability of various stages of lipid abnormality are not statistically significant.

Chart - 9 : Stagewise comparison of C.K.D. and lipid abnormalities

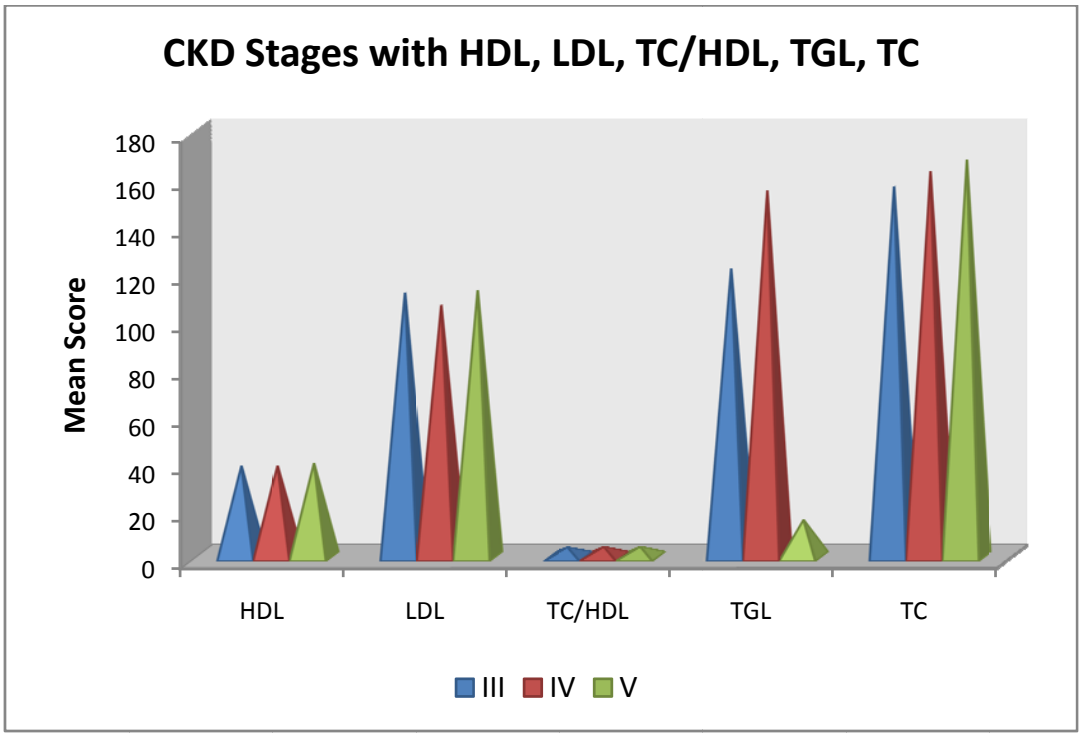


Table - 10 : Analyses and assessment of classification of HDL level among the C.K.D. cases stage wise.

HDL	3		4		5		TOTAL	
	N	%	N	%	N	%	N	%
Low	5	62.50	14	70.00	12	54.50	31	62.00
High	3	37.50	6	30.00	10	45.50	19	38.00
Total	8	100	20	100	22	100	50	100
Chi-square	1.06							
df	2							
p-value	0.59 (Not Significant)							

Only stage IV had maximum number of low HDL levels,14 patients (28%)

31 patients (62 %) had HDL levels<40mg/dl

19patients (16.6%) had HDL levels >40mg/dl.

The association was not significant**. (**p value 0.59)

Chart - 10 : Analyses and assessment of classification of HDL level among the C.K.D. cases stage wise.

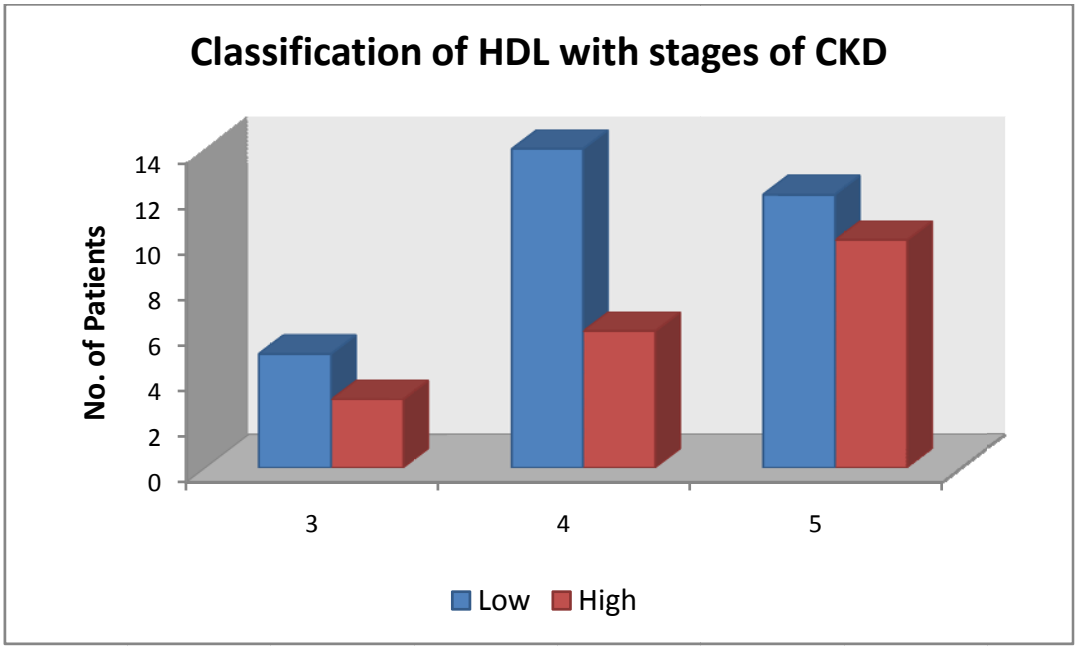


Table - 11 : Analyses and assessment of classification of LDL level among the C.K.D. cases stage wise.

	3		4		5		TOTAL	
LDL	N	%	N	%	N	%	N	%
Optimal	4	50.00	12	60.00	8	36.40	24	48.00
Near Optimal	1	12.50	2	10.00	6	27.30	9	18.00
Borderline high	2	25.00	2	10.00	6	27.30	10	20.00
High	1	12.50	1	5.00	2	9.10	4	8.00
Very.high	0	0	3	15.00	0	0	3	6.00
Total	8	100	20	100	22	100	50	100
Chi-square	9.77							
df	8							
p-value	0.28 (Not Significant)							

Analyses and assessment of classification of LDL level among the C.K.D. cases stage wise.

Only stage IV had very high LDL levels

24 (48%) patients had optimal LDL levels(<100mg/dl),

9 (18%) patients had near optimal LDL levels, (100-129mg/dl)

10(20%) patients had borderline high.(130-155mg/dl)

4patients had high (160-189mg/dl) and 3 patients had very High (≥190mg/dl) values. p-value (>0.05), the association was not statistically significant.

Chart - 11 : Analyses and assessment of classification of LDL level among the C.K.D. cases stage wise.

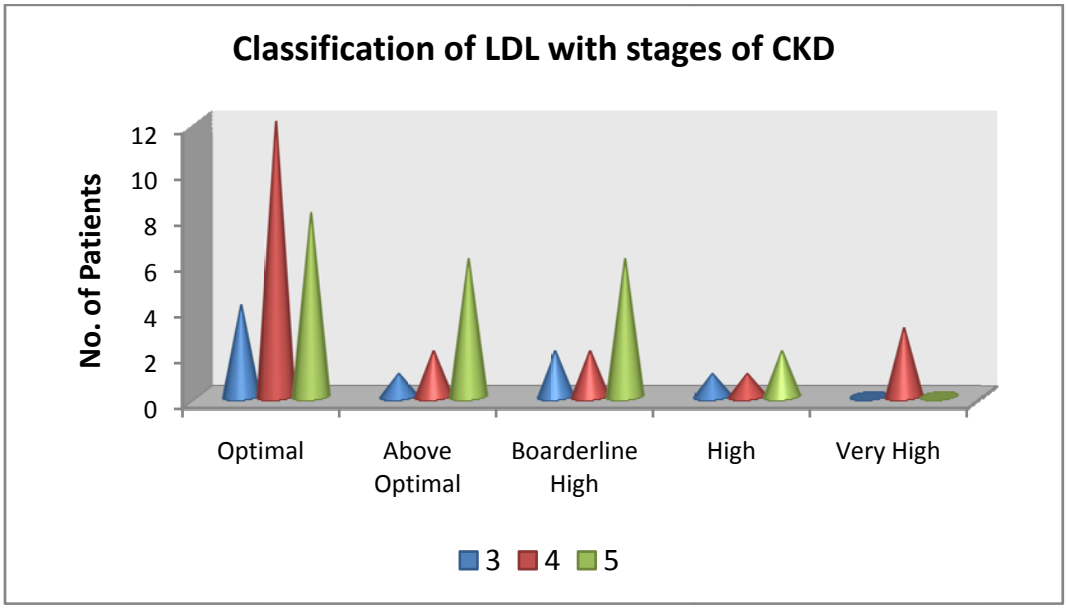


Table - 12 : Analysis and assessment of classification of TC level among the C.K.D. cases stage wise.

	3		4		5		TOTAL	
TC	N	%	N	%	N	%	N	%
Desirable	6	75.00	17	85.00	17	77.30	40	80.00
Borderline High	2	25.00	2	10.00	4	18.20	8	16.00
High	0	0	1	5.00	1	4.50	2	4.00
Total	8	100	20	100	22	100	50	100
Chi-square	1.42							
df	4							
p-value	0.09 (Not Significant)							

Stage V had the maximum number of borderline high patients

40 patients (80%) had desirable TC levels (<200mg/dl)

8patients (16%) had borderline high TC levels,(200-239mg/dl)

2 patients(2%) had high TC levels(≥240mg/dl).

The association was not statistically significant. P value(>0.05)

Chart - 12 : Analysis and assessment of classification of TC level among the C.K.D. cases stage wise.

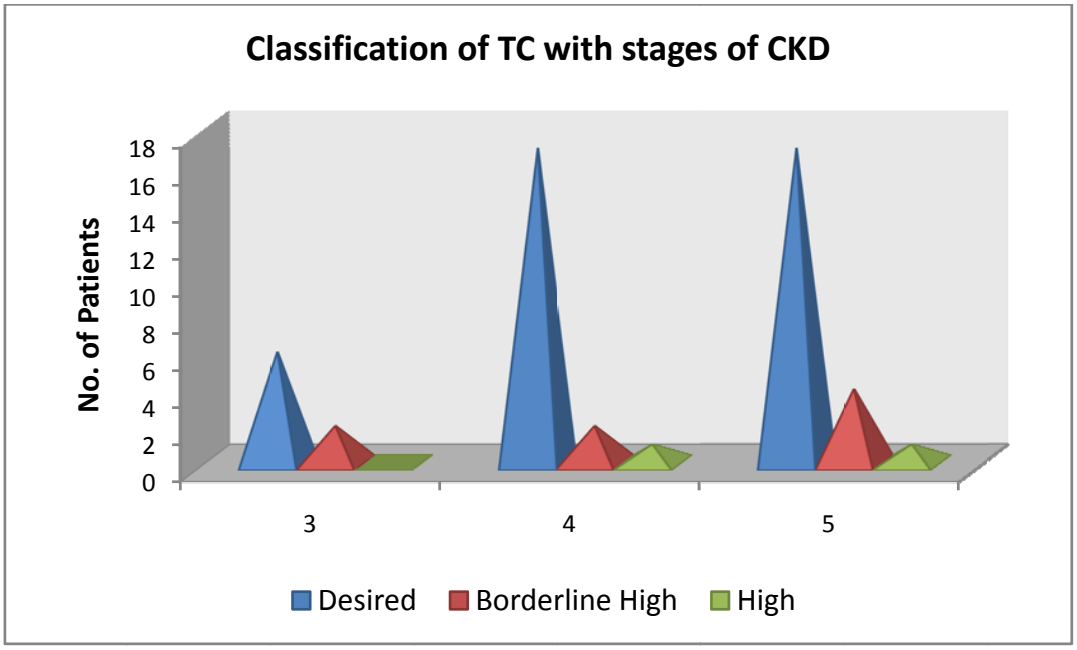


Table - 13 : Analysis and assessment of classification of TGL level among the C.K.D. cases stagewise.

	3		4		5		TOTAL	
TGL	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Normal	7	87.50	11	55.00	13	59.10	31	62.00
Borderline High	1	12.50	3	15.00	4	18.20	8	16.00
High	0	0	6	30.00	5	22.70	11	22.00
Very High	-	-	-	-	-	-	-	-
Total	8	100	20	100	22	100	50	100
Chi-square	3.51							
df	4							
p-value	0.48 (Not Significant)							

Analysis and assessment of classification of TGL level among the C.K.D. cases stagewise.

Stage IV had 6 high triglyceride patients(12%) and Stage V had 5 high triglyceride patients(10%).

31 patients (62%) had normal TG values (<150mg/dl)

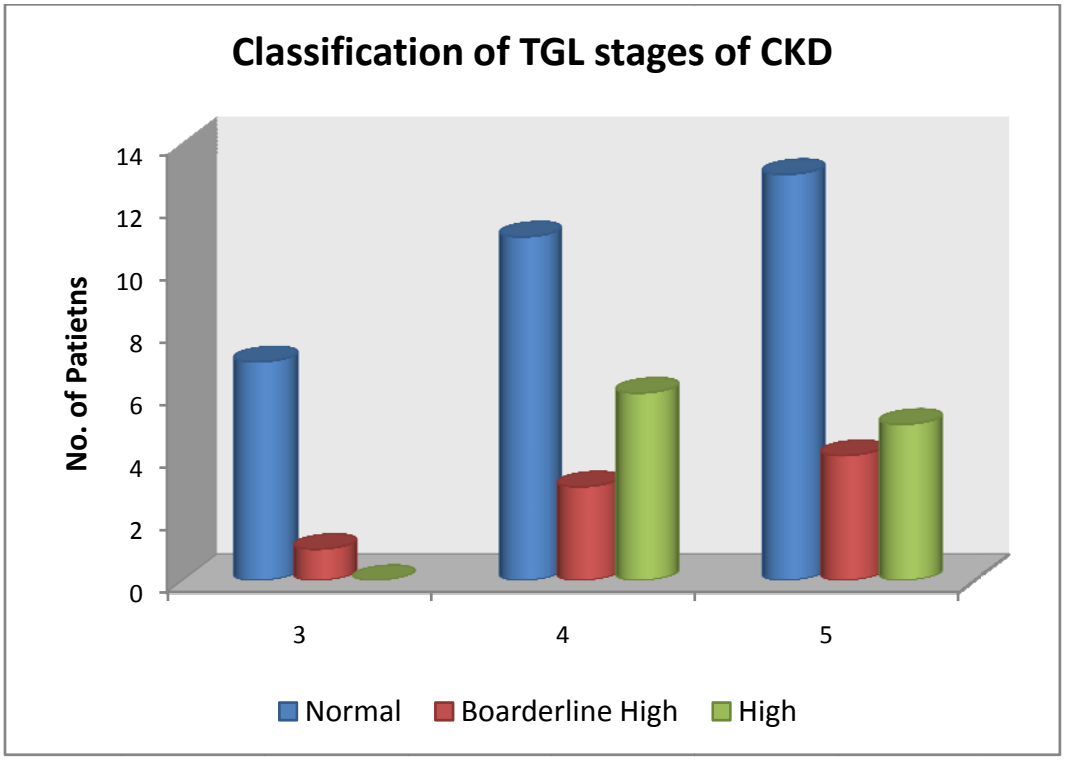
8 patients (16%) had borderline TG values, (150-199mg/dl)

11 patients (22%) had high TG values (200-499mg/dl),

No patients had very high TG levels

The association is not significant (p value 0.48)

Chart - 13 : Analysis and assessment of classification of TGL level among the C.K.D. cases stagewise.



DISCUSSION

This study was done to identify the lipid abnormalities that occur in the CKD patients admitted in Govt. Mohan Kumaramangalam Medical College, Salem

A total of 50 cases who fulfilled the inclusion and exclusion criteria CRF, were included in the study. 50 age and sex matched healthy controls were taken for comparing the lipid profile.

Among 50 cases the mean age was 48. 38 yrs and the mean age of controls was 51.66 yrs. There was no significant difference between cases and controls with regard to the age. (P value –0.09). So they can be compared.

There were 27 males and 13 females in the study group. Among the 50 controls, 30 were males and 20 were females. There was no significant difference between cases and controls as far as sex is concerned. (Pvalue–0.53)

The results of the study on the lipid disorders in patients with chronic renal failure show that there are significant alterations in the lipid profiles of these patients as compared to controls.

Triglycerides:

Our study demonstrated an increase in Triglycerides between cases and controls. (147.6mg/dl vs127.8 mg / dl). This was significant statistically. (P values <0.05).This result was in concordance with the work done by E.Kimak and team[69], in which they demonstrated a significant increase in Triglycerides, LDL and Apo-B concentrations.In another study, done by Bhagwat.R , Joshi S P and team[70], they concluded that CRF patients were having marked triglyceridemia of 232 mg / dl as compared to controls.(P value less than 0.01) .Another Indian study on dyslipidemia in patients with CRF and renal transplantation by B.Shah, S.Nair and coworkers[71] they demonstrated that triglycerides was elevated significantly in CRF patients on conservative management. These results shows that hypertriglyceridemia is an important lipid abnormality in patients with CRF. Attman P.O, Alaupovic P[72]stated that hypertriglyceridemia is the most common plasma lipid abnormality in patients of chronic renal failure.

VARIOUS STUDIES ON PROGRESSION OF KIDNEY DISEASE AND ASSOCIATED PLASMA LIPID ABNORMALITIES:

Study	***Patients***	***Number of patients***	***Follow up***	***Lipidpattern***
MDRD	CKD	840	2.2 YRS	↓HDL
Samuelsson O et al[62]	CKD	73	3.2 YRS	↑TCh, ↑LDL, ↑ApoB
Locatelli et al[74]	CKD	456	2 YRS	No relationship

HDL Cholesterol:

Our study demonstrated a significant decrease in HDL in CRF cases when compared with controls (38.8mg/dl vs 54mg/dl) (P value 0.0001). This was in concordance with the results obtained by Bhagwat R and team[70] where they found HDL cholesterol to be significantly low. (20 ± 11)mg/ dl(P value less than 0.001) in CRF groups. P.O. Attman et al[72] found decrease in plasma HDL cholesterol concentration in patients with CRF.

LDL Cholesterol:

Our study demonstrated an increase in LDL cholesterol between cases and controls. (110 mg/dl vs101.6 mg / dl). This was not significant statistically, p value (0.24). This was similar to the study by Bhagwat R and Joshi S P[70] where, they found that LDL cholesterol in CRF patients showed an increase when compared to controls which, is not statistically significant. Study by E.Kimak and team[69] showed results not comparable to our study, where LDL cholesterol showed significant increase among CRF patients compared with controls in their study.

Total Cholesterol:

Our study demonstrated a decrease in total cholesterol between cases and controls. (164 mg/dl vs176.3 mg / dl). This was not significant statistically, p value (0.07). N.D. Vaziri[73] concluded that plasma cholesterol can be normal or decreased, as occured in our study. E.Kimak and coworkers[69] in their work on plasma lipoproteins in CRF patients concluded that total cholesterol is not increased significantly in patients with CRF. P.O. Attmanet al[72] in their study showed no significant change in levels of total cholesterol.

TC/HDLRATIO:

Our study demonstrated a increase in the Total cholesterol HDL ratio between the cases and the controls (4.3Vs 3.4). This was statistically significant (p value <0.05)

COMPARISON OF LIPID PROFILE BETWEEN OTHER STUDIES AND OUR STUDY

Studies		***TGL***	***LDL***	***HDL***	***T***
Shah et al	S	222.78±90.08	109.63±36.51	52.69±16.36	211.33±40.33
	C	121.78±64.89	140.33±23.34	44.22±10.33	184.11±18.79
Diana Mlee etal	S	194.05±106.28	170.148±50.27	38.6±11.6	239.75±61.8
	C	106.28±26.5	131.47±30.93	42.53±7.73	189.14±30.93
Our study	S	147.68±61.57	110.08±45.10	38.86±8.04	164.02±39.9
	C	127.86±27.23	101.62±23.76	54.04±10.74	176.34±24.37

S - Study; C - Control

Stagewise comparison of C.K.D. and lipid abnormalities:

We have no study group fitting into stage I and II kidney disease, we analyzed the other 3 stages of CKD. The decrease in HDL observed in 3 group (mean 38.38, 38.40, 39.45) respectively are not statistically significant in severity when compared with stages (P>0.05). Similarly rise in TGL observed in III IV and V stage of CKD having mean value

(121.88, 154.8, 150.59) respectively are not statistically significant in severity when compared with stages (P>0.05). The rise in LDL obtained in III, IV and V stages of CKD having mean value (111.75, 106.45, 112.7) respectively, on comparison are not statistically significant (P>0.05). The decrease in Total Cholesterol obtained in III, IV and V stages of CKD having mean value (156.75,162.80,167.77) respectively, on comparison are not statistically significant. The rise in Total cholesterol HDL ratio obtained in III, IV and V stages of CKD having mean value (4.08,4.36,4.37) respectively, on comparison are not statistically significant. Though we found lipid abnormalities in form of ↑TGL ↑ LDL, ↓ HDL,↓TC,↑TC/HDL ratio in study group in all stage of CKD, this alteration is not statistically significant in severity on comparison by using this statistical package (S.P.S.S) in form of paired 't' test and anova test.

According to the E. Kimak and coworkers[69] study, the increase in TG,TC, LDL & ↓ HDL levels were significant in early stages of kidney disease and in end stage kidney disease, there is not much alteration in lipid profile.

Stagewise comparison of stages of CKD and Categories of Lipids

The lipid pattern abnormalities are classified according to ATP III Classification and they are compared to Stages of CKD.

HDL cholesterol was divided into low and high and compare to stage III, IV, V of CKD, >60% had low HDL values, the comparison was not statistically significant.(p value 0.59 by chi square).

TGL was classified into Normal, Borderline High, High and Very High and compared to the to stage III, IV, V of CKD, maximum number was in normal group, next to that was high group, but the comparison was not statistically significant(p value 0.48 by chi- square)

LDL was classified into Optimal, Near Optimal, Borderline High, High and Very High and compared to the stage III, IV, V of CKD, percentage of optimal group was the maximum, next to that was the Borderline high group. But the comparison was not statistically significant (p value 0.28 by chi- square)

TC was classified into Desirable, Borderline High, High and compared to the stage III, IV, V of CKD, percentage of Desirable was the maximum and next to that was the Borderline High group, but the comparison was not statistically significant (p value 0.09 by chi- square)

Hence it is stated from our study that there is no direct relationship between derangement of lipid abnormalities and staging of CKD.

CONCLUSION

Lipid abnormalities are common in CKD and are found to occur in all stages of CKD.

HDL – C shows a statistically significant decrease in CKD patients compared with controls and it is the predominant lipid pattern abnormality in our study.

Triglycerides shows statistically significant increase in CKD cases when compared with controls.

LDL–C was increased in CKD patients but it is not statistically significant when compared with controls.

The TC/HDL ratio was increased CKD patients and it is found to be statistically significant

Total Cholesterol is decreased in CKD patients but, it is not statistically significant when compared with controls.

The lipid abnormalities started to occur even in the earlier stages of CKD.

The severity of chronic kidney disease did not correlate with the severity of lipid abnormalities and it was found to be statistically insignificant.

Finally, because the lipid abnormalities in chronic renal failure predisposes to atherosclerosis and accelerates the progression of the renal failure it is worthwhile detecting and treating hyperlipidemia in CKD patients.

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ACRONYMS

ABCA1	_	ATP-binding cassette subfamily A member 1;
ABCG1	_	ATP-binding cassette subfamily G member 1
ACAT	_	Acyl CoA :cholesterol acyltransverase
ACE	_	Angiotensin converting enzyme
ACVD	_	Atherosclerotic cardio vascular disease
ATP	–	Adult treatment panel
ARB	–	Angiotensin receptor blocker
CETP	–	Cholesteryl ester transfer protein
CM	–	Chylomicron
CHD	_	Coronary heart disease
CKD	–	Chronic kidney disease
CRF	–	Chronic renal failure
ESRD	–	End stage renal disease
GFR	–	Glomerular filtration rate
HDL	–	High density lipoprotein

HL	–	Hepatic lipase
IDL	–	Intermediate density lipoprotein
LDL	–	Low density lipoprotein
LCAT	–	Lecithin cholesterol acyl transferase
LPL	–	Lipoprotein lipase
MDRD	_	Modified diet in renal disease
MTP	–	Microsomal transfer protein
NS	–	Nephrotic syndrome
SRB1	_	Scavenger receptor B1
TC	–	Total cholesterol
TGL	–	Triglycerides
VLDL	–	Very low density lipoprotein

PROFORMA

Name	Age	Sex
IP Number	Occupation	
Address		

Presenting complaints

Oliguria

Pedaledema

Nausea,

vomiting

Pruritus

Hiccups

Facial puffiness

Dyspnea

Past history

Diabetes

Hypertension

TIA

Stroke

Drug history

Thiazides, Betablockers, Steroids

Family history

H/o Diabetes, Hypertension, Hyper lipidemia

Personal history

Smoking Alcoholism

General examination

Pallor

Icterus

Cyanosis

Clubbing

Lymphadenopathy

Pedal Edema

Facial puffiness

JVP

Evidence for hyperlipidemia

Xanthelasma:

Arcus:

Tendinous (or) Eruptive xanthoma:

Height :

Weight :

Vitals Pulse BP RR Temp

CVS

RS

Abdomen

CNS

Investigations

Urine

Albumin, Sugar, Deposits

Blood

Sugar

Hb, TC, DC

Renal function tests

Blood Urea

Serum creatinine

USG abdomen for kidney size:

Fasting lipid profile:

Total cholesterol,

HDL,

LDL,

Triglycerides,

Total Cholesterol/ HDL ratio:

FINAL DIAGNOSIS

MASTER CHART OF STUDY GROUP

Sl No.	NAME	AGE	SEX	WT.	SERUM CREATININE µmol/l	CREATININE CLEARANCE ml/min.	STAGING	HDL mg/dl	LDL mg/dl	TGL mg/dl	TC mg/dl	TC/HDL
1	KULANDAISAMY	53	M	65	800	8.7	5	37	144	118	208	5.6
2	JANAGI	62	F	55	290	15.4	4	39	86	253	179	4.5
3	DURAI	51	M	60	836	7.8	5	46	62	148	138	3
4	PERIYANAYAGI	60	F	60	1188	4.2	5	53	157	175	248	4.7
5	THIRUVENGADAM	54	M	62	783	8.4	5	30	124	226	114	3.8
6	VARADARAJAN	39	M	53	239	27.5	4	49	110	90	180	3.7
7	MALAISELVI	42	F	53	504	10.8	5	57	95	161	181	3.1
8	IMAM	43	M	42	336	14.9	5	28	88	69	133	4.7
9	PAVAYEE	23	F	50	203	30.1	3	30	59	106	113	3.6
10	KANNIYAMMAL	55	F	49	1017	4.3	5	31	66	99	121	3.7
11	ALEXANDER	38	M	65	327	24.9	4	51	75	155	160	3.1
12	JAGADAMBAL	57	F	48	451	9.2	5	46	133	138	193	4.2
13	MANGAMMAL	60	F	47	212	18.5	4	40	57	103	82	2
14	SARADHA	26	F	46	318	17.2	4	40	151	119	180	4.5
15	RAJALAKSHMI	38	F	48	830	6.2	5	38	171	190	136	3.5
16	AYYADURAI	55	M	52	362	15	4	42	77	102	107	2.5
17	KALIYAMMAL	51	F	45	239	17.5	4	46	80	105	55	1.1
18	NANDINI	42	F	59	221	27.3	4	26	97	106	148	5.7

Sl No.	NAME	AGE	SEX	WT.	SERUM CREATININE µmol/l	CREATININE CLEARANCE ml/min.	STAGING	HDL mg/dl	LDL mg/dl	TGL mg/dl	TC mg/dl	TC/HDL
19	ANGURAJ	67	M	60	239	22.5	4	38	53	150	124	3.2
20	MANIKANDAN	53	M	49	1414	3.6	5	40	85	264	181	4.5
21	SELVI	31	F	57	539	12	5	41	57	134	149	3.6
22	MARIMUTHU	50	M	67	203	36.5	3	36	89	85	145	4
23	GOVINDASAMY	61	M	52	1502	3.4	5	41	119	192	127	3
24	GANESAN	45	M	65	839	9	5	33	110	254	158	4.7
25	PERIYAKKA	42	F	60	283	21.7	4	50	125	203	219	4.4
26	PRAKASH	18	M	42	1635	3.8	5	42	176	236	176	4.2
27	MADHAYAN	62	M	65	256	24.3	4	44	70	278	173	3.9
28	PERIYASAMY	62	M	67	345	18.6	4	33	44	146	109	3.3
29	CHELLAPPAN	56	M	63	274	23.7	4	34	217	188	218	6.4
30	ARUNACHALAM	54	M	60	203	31.2	3	46	131	103	201	4.3
31	NADEASAN	63	M	59	185	30.2	3	42	147	142	166	3.9
32	RANGASAMY	59	M	54	256	21	4	24	60	106	108	4.5
33	VIRUDAMBAL	64	F	54	611	7	5	55	38	36	111	2
34	SELVARAJ	30	M	59	513	15.5	4	38	176	206	178	4.7
35	KANNIYAPPAN	42	M	62	248	30.1	3	36	168	186	172	4.7
36	KARUPPASAMY	45	F	64	212	29.9	4	32	200	226	192	6
37	KUPPUSAMY	52	M	61	309	21.3	4	38	134	75	190	5

Sl No.	NAME	AGE	SEX	WT.	SERUM CREATININE µmol/l	CREATININE CLEARANCE ml/min.	STAGING	HDL mg/dl	LDL mg/dl	TGL mg/dl	TC mg/dl	TC/HDL
38	VALLI	59	F	44	186	20	4	40	201	94	263	6.5
39	ARULMURUGAN	32	M	54	902	7.9	5	30	107	84	159	5.3
40	MANI	54	M	72	203	37.5	3	54	126	105	204	3.7
41	DHANAPAL	28	M	54	1176	6.3	5	36	154	128	169	4.7
42	NAGAPPAN	65	M	48	698	6.3	5	27	76	96	126	4.6
43	AMMASI	69	M	67	248	23.6	4	34	46	140	161	4.7
44	SAKTHIVEL	42	M	65	265	29.5	4	30	70	251	153	5.1
45	NALLUSAMY	60	M	70	221	31.1	3	32	99	148	104	3.2
46	RAJAPPAN	42	M	67	194	41.6	3	31	75	100	129	4.1
47	IRULLAPPAN	50	M	60	893	7.4	5	37	144	118	208	5.6
48	CHINNAMAYIL	17	F	42	734	7.3	5	48	138	96	208	4.3
49	PERUMAN	40	M	77	1250	7.6	5	30	120	273	209	6.9
50	AYYASAMI	56	M	45	387	12	5	42	117	78	177	4.2